522

REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

APPENDIX A
FINAL
SAMPLING AND ANALYSIS PLAN
VOLUME II

TES

0714

WEST LAKE LANDFILL
OPERABLE UNIT 2
BRIDGETON, MISSOURI

Prepared for:

LAIDLAW

LAIDLAW WASTE SYSTEMS INC.

Prepared by:

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WEST LAKE LANDFILL
OPERABLE UNIT 2
BRIDGETON, MISSOURI

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REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN
APPENDIX A-2
FINAL
QUALITY ASSURANCE PROJECT PLAN

ATTACHMENT 1

QUANTERRA LABORATORY
QUALITY ASSURANCE PROJECT PLAN

Quanterra
Environmental Services

Quality Assurance Management Plan for Environmental Services

Revision 0
March 20, 1995

Quality Assurance Management Plan for Environmental Services

Quanterra Incorporated

Approved by:

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Controlled Copy Number: ________________

ERRATA

The following corrections are made to the Quanterra QAMP, Rev 0 (March 20, 1995)

<u>Section 8.5.2.4 Sample Holding Times</u>

Replace 24 hours with 48 hours (both occurrences) on page 70 of 100. The last sentence of the first paragraph on page 70 shall read:

> "Quanterra laboratories are responsible for meeting all holding times for samples received within 48 hours of collection or if less than half the holding time has passed at the time of sample receipt if the sample is received after 48 hours of collection."

<u>Section 8.6.1 Data Quality Assessment</u>

Delete from the second column of page 76 of 100:

> "If in-house limits are within the bounds of published limits, the published limits must be used. Investigation and corrective action are required to ensure improvement in method performance and to meet method performance specifications."

Preface

The purpose of the Quanterra Quality Assurance Management Plan for Environmental Services (QAMP) is to provide internal guidance to Quanterra laboratory operations which will ensure that our laboratories are operating under a standardized, rigorous quality assurance program. In operating under this program, we will be able to consistently provide our clients with data that is of known and documented quality and is legally defensible. Another equally important purpose of this document is to fulfill the requirement of our clients and pertinent government programs of documenting our quality assurance program.

The QAMP contains many references to other Quanterra quality documents. These Quanterra quality documents, including the QAMP, the QMP, Policy Documents, and Standard Operating Procedures (both corporate and laboratory-specific) all impact the quality of our products and intertwine to produce a strong quality assurance program within Quanterra. This program is the foundation that provides our operations with guidance and ensures that we will consistently produce quality deliverables.

The format of this document follows the basic outline required for a quality management plan as described in the EPA QA/R-2 document[1]. Table 2.3-1 cross-references the narrative sections of the QAMP to the appropriate sections of the EPA QA/R-2 document as well as to several other well-known, published quality assurance programs.

It was known during the design stage that this document would contain a large amount of technical information in both narrative and tabular form. A document layout and format was designed to allow the reader to quickly locate information. An index has been included in this document to aid the reader in locating specific terms. A glossary is also included for the purpose of standardizing Quanterra's definitions of terms used throughout the document.

There are two basic types of information contained in the QAMP. Global information, or that which applies to all Quanterra laboratories, describes the quality control requirements and acceptance criteria that apply to day-to-day laboratory performance as well as to samples throughout the life of the sample from receipt to the reporting of resulting data. It also provides the required corrective actions that must be taken when these criteria are not met. Operation-specific information describes the quality control requirements that apply only to a specific operating unit. This type of information, such as method detection limits, performance evaluation studies, and laboratory standard operating procedures cannot be standardized throughout the Quanterra laboratory network due to the fact that they may be client-specific, laboratory-specific, or instrument-specific. This operation-specific information has been placed in the Facility Appendix to this document.

[1] "Interim Draft EPA Requirements for Quality Management Plans", EPA QA/R-2, United States Environmental Protection Agency, Quality Assurance Management Staff, Washington, DC 20460, July 1993.

Preface (continued)

The following table displays the breakdown of the QAMP. The applicability of each section to Quanterra is given.

QAMP Design Breakdown and Applicability to Quanterra

QAMP Section	Applicability
Sections 0 through 10 (figures included)	Applies to all Quanterra laboratories
Index	Applies to Sections 0 through 10 and the Tables
Glossary	Applies to the entire QAMP
Table Section	Applies to the section that the table is described in. Table numbers contain three digits. The first two numbers refer to the section number and the subsection number where the table is first referenced. The third number is consecutive starting with 1 for each document section. For example, the first table referenced in Section 8.4 is numbered Table 8.4-1, and the second table referenced in Section 8.4 is numbered Table 8.4-2, and so on.
Appendix A (Non-Operations Organizational Charts)	Applies to Quanterra non-laboratory management and laboratory support groups
Appendix B (Facility-Specific. Contains a section for each Quanterra laboratory.)	Applies only to the section in this appendix entitled with the laboratory location. These sections contain information that is specific only to that operating unit.
Appendix C (Addresses of Quanterra Locations)	Lists all Quanterra locations and addresses.

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Table of Contents (continued)

Table of Contents (continued)

List of Figures

List of Tables (See Table Section)

List of Tables (See Table Section)

List of Appendices

Appendix A — Non-Operations Organizational Charts

Appendix B — Facility-Specific Appendix : ***This appendix contains facility-specific quality-related information and requirements for Quanterra laboratories. These laboratories are located in the following cities:***

- Anchorage, Alaska
- Austin, Texas
- City of Industry, California
- Denver, Colorado
- Knoxville, Tennessee
- North Canton, Ohio
- Pittsburgh, Pennsylvania
- Richland, Washington
- Sacramento, California
- Santa Ana, California
- St. Louis, Missouri
- Tampa, Florida

Each laboratory section in this appendix contains information specific to that laboratory only and contains the following basic outline:

Section	Contents
0	Table of Contents
1	Organizational Chart
2	Instrument List
3	Standard Operating Procedures List
4	Analytical Methods
5	MDLs, RLs, and CRDLs
6	Performance Evaluation Studies
7	Additional Operation-Specific Information

Appendix C — Addresses of Quanterra Locations

Acronyms and Initialisms

AA	Atomic Absorption
ANSI	American National Standards Institute
AR/COC	Analysis Request/Chain-of-Custody
ASQC	American Society for Quality Control
ASTM	American Society for Testing and Materials
BFB	Bromofluorobenzene
BLK	Blank
BOD	Biochemical Oxygen Demand
CAT	Corrective Action Team
CEO	Chief Executive Officer
CF	Calibration Factor
CFR	Code of Federal Regulations
CHP	Chemical Hygiene Plan
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COD	Chemical Oxygen Demand
CRDL	Contract Required Detection Limit
CRM	Certified Reference Material
CRQL	Contract Required Quantitation Limit
CST	Customer Service Team
CUR	Condition Upon Receipt
CV	Coefficient of Variation
CVAA	Cold Vapor Atomic Absorption Spectroscopy
DFTPP	Decafluorotriphenylphosphine
DOC	Dissolved Organic Carbon
DOE	Department of Energy
DOT	Department of Transportation
DQO	Data Quality Objective
EH&S	Environmental Health and Safety

Acronyms and Initialisms (continued)

EPA	U. S. Environmental Protection Agency
FAS	Field Analytical Services
FLAA	Flame Atomic Absorption Spectroscopy
FTIR	Fourier Transform Infrared Spectrometry
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
GFAA	Graphite Furnace Atomic Absorption Spectroscopy
HDPE	High Density Polyethylene
HPLC	High Performance Liquid Chromatography
HRGC	High Resolution Gas Chromatography
HRMS	High Resolution Mass Spectrometry
ICAP	Inductively Coupled Argon Plasma Spectroscopy
ICAP/MS	Inductively Coupled Argon Plasma/Mass Spectrometry
IDL	Instrument Detection Limit
IR	Infrared Spectroscopy
IS	Information Systems
ISO	International Organization for Standardization
KRI	Key Result Indicator
LAN	Local Area Network
LCL	Lower Control Limit
LCS	Laboratory Control Sample
LRGC	Low Resolution Gas Chromatography
LRMS	Low Resolution Mass Spectrometry
LWL	Lower Warning Limit
MBAS	Methylene Blue Active Substance
MDA	Minimum Detectable Activity
MDC	Minimum Detectable Concentration
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate

Acronyms and Initialisms (continued)

MSDS	Material Safety Data Sheet
NCM	Nonconformance Memo
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards Technology
NMOC	Non-Methane Organic Compounds
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRM	National Reference Material
PAH	Polynuclear Aromatic Hydrocarbons (or PNA)
PCB	Polychlorinated Biphenyls
PE	Performance Evaluation
PM	Project Manager
PQL	Practical Quantitation Limit
PSRL	Project-Specific Reporting Limit
PUF	Polyurethane Foam
QA	Quality Assurance
QAMP	Quality Assurance Management Plan
QAPjP	Quality Assurance Project Plan
QAPP	Quality Assurance Program Plan
QAS	Quality Assurance Summary
QC	Quality Control
QIT	Quality Improvement Team
QMP	Quality Management Plan
QMS	Quality Management System
QuantIMS	Quanterra Laboratory Information Management System
QRI	Quality-Related Item
RCRA	Resource Conservation Recovery Act
RF	Response Factor
RL	Reporting Limit
RPD	Relative Percent Difference

Acronyms and Initialisms (continued)

RRF	Relative Response Factor
RSD	Relative Standard Deviation
SOP	Standard Operating Procedure
SPCC	System Performance Check Compounds
SRL	Standard Reporting Limit
SRM	Standard Reference Material
TCLP	Toxicity Characteristic Leaching Procedure
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TOX	Total Organic Halides
UCL	Upper Control Limit
USEPA	United States Environmental Protection Agency
UWL	Upper Warning Limit
VOA	Volatile Organic Analyte
VOST	Volatile Organic Sampling Train
WAN	Wide Area Network
WS	Water Supply
WP	Water Pollution

1.0 Management Commitment and Organization

1.1 Mission Statement

Quanterra's mission is to be recognized as the premier provider of environmental laboratory services by being world class in quality and technology and by setting the standard of excellence within the industry. We will create an environment that will stimulate and encourage innovation and continuous improvement of our processes, systems, and structure to achieve this mission.

1.2 Statement of Management Position on Quality

Quanterra's management is committed to providing quality services that meet the requirements of our clients and satisfy regulatory requirements. Management is dedicated to providing an environment that encourages the achievement of excellence, demands integrity in all aspects of its operations, and requires active participation of all associates and vendors in meeting its quality goals.

A comprehensive Quality Management System (QMS) has been developed which ensures that Quanterra's clients receive high quality analytical and environmental services that are timely, reliable, and meet their intended purpose in a cost-effective manner. The QMS provides an organizational structure that ensures quality in its work processes, products, and services. The Quanterra QMS is described in the Quanterra Quality Management Plan (QMP), and applies to all technical, business, and administrative functions at Quanterra. The principles and practices described in this QMP apply to all Quanterra associates at every level and are fundamental to the services we provide and to the way we do business. These principles and practices, as they are applied by Quanterra's laboratories, are further described in this Quality Assurance Management Plan (QAMP).

The Quanterra QMP provides the blueprint for planning, implementing, and assessing the Quanterra QMS. It is an overall statement of policy as well as a plan used to implement quality programs throughout the company. Each business function of the organization shall put in place plans, policies, and procedures that will meet the requirements of the QMP as guided by the QAMP. The QMP and QAMP provide guidance to Quanterra associates in fulfilling their responsibilities and serve as a statement to clients, agencies, and associates of Quanterra's commitment to quality.

Implementation of the QMP and QAMP is the responsibility of all Quanterra associates.

Management at every level has the duty and authority to lead the development and implementation of a structured management system that supports the quality programs. Management must assure that the principles and practices of the quality program are followed and implemented.

1.3 Organizational Structure

Quanterra is incorporated in the state of Delaware with corporate headquarters in Englewood, Colorado. The organizational structure for Quanterra is presented in Figure 1.3-1. Laboratory locations are given in the List of Appendices in Section 0.0. Detailed organizational charts for corporate support groups are given in Appendix A. The organizational structure for each laboratory is presented in Appendix B. The responsibilities and authorities of the members of the organization, as they relate to quality management, are outlined in Section 1.4.

At some Quanterra laboratories, positions identified in this section may not exist due to the laboratory size or other factors. In these cases, the responsibilities and authorities described here are assigned to other positions by the Laboratory Director or next senior level of management as appropriate.

1.4 Quality Organization

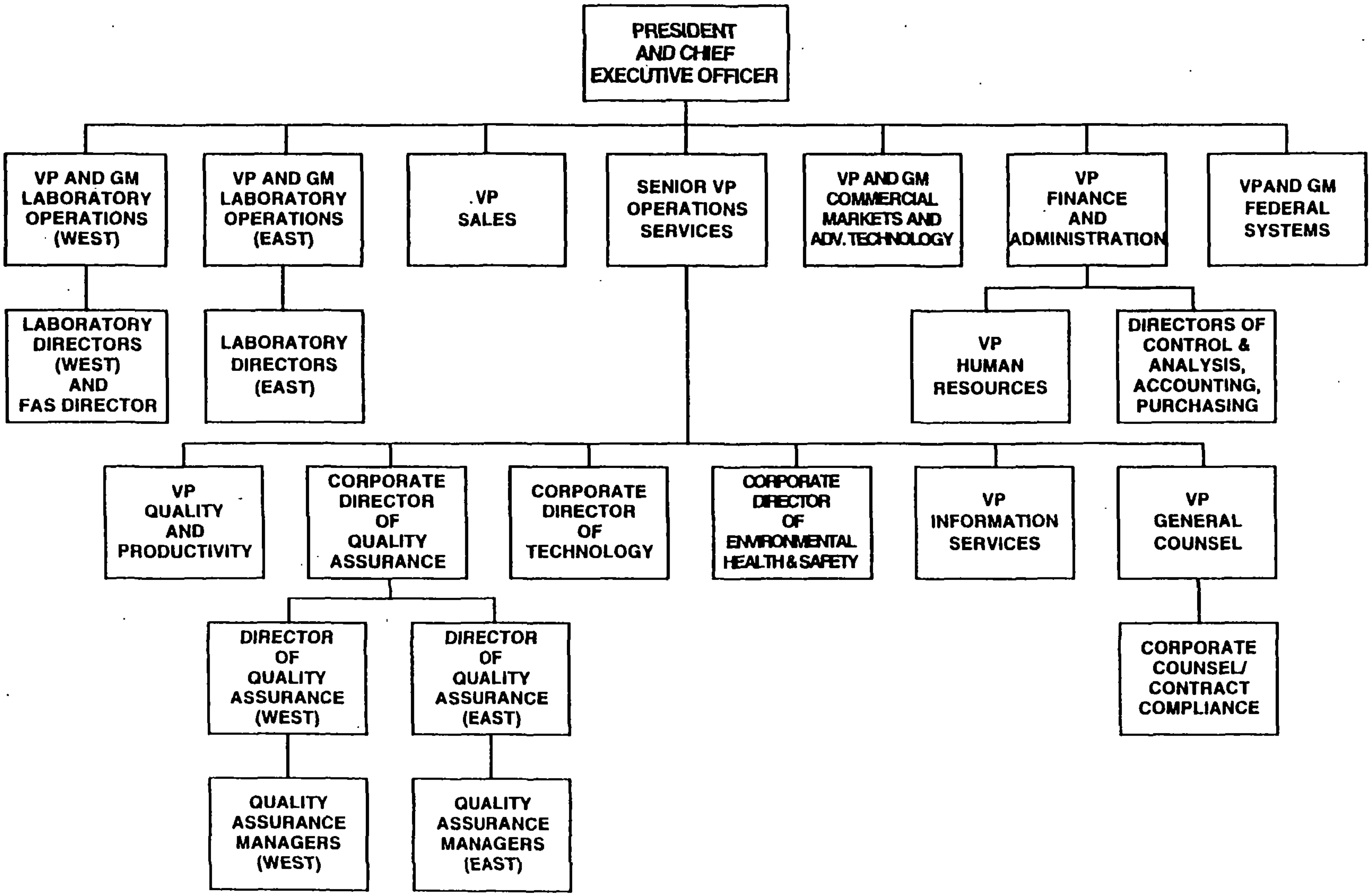
The achievement of quality in all activities is the responsibility of each Quanterra associate and is led by management. Quality-related responsibilities within the organization provide for the implementation of the QMP, the QAMP, and completion of quality control (QC) activities. The following sections describe these activities for key Quanterra positions. The quality-related responsibilities may be reassigned by dividing the activities among different individuals or enhanced by adding activities, but they must not be eliminated. The accountability is retained by the person delegating the activity or by the person assigned the activity by the next senior level of management.

1.4.1 President and Chief Executive Officer

- Reports directly to the Board of Directors
- Approves the Quanterra QMP
- Responsible for overall corporate policy and strategy for quality
- Responsible for maintaining effective quality management
- Provides the resources to implement the Quanterra QMP.

FIGURE 1.3-1

QUANTERRA INCORPORATED



1.4.2 Senior Vice President of Operations Services

- Reports directly to the President and Chief Executive Officer (CEO)
- Approves the Quanterra QMP, QAMP, and Quality Policy Documents
- Responsible for the quality of all Quanterra support services
- Provides the resources to implement the Quanterra QMP for support services.

1.4.3 Corporate Director of Quality Assurance

- Reports directly to the Senior Vice President of Operations Services
- Approves the Quanterra QMP, QAMP, Quality Policy Documents, and corporate Standard Operating Procedures (SOP)
- Serves as a technical consultant and resource on quality issues to ensure uniform excellence in quality and regulatory analytical compliance at all Quanterra operations
- Responsible for assessing, maintaining, and improving the QMP and QAMP
- Supervises and provides guidance and training to corporate quality assurance (QA) staff
- Suspends processing when quality requirements are not met
- Oversees independent audits of Quanterra laboratories to identify areas where improvement is needed to comply with the QAMP
- Verifies completion of corrective actions required to correct nonconformances identified during audits
- Responsible for reporting all matters of quality assurance to the President and senior management.

1.4.4 Regional Director of Quality Assurance

- Reports directly to the Corporate Director of Quality Assurance and indirectly to the Vice President and General Manager of Laboratory Operations for the region; member of Corporate QA staff
- Approves the Quanterra QAMP and the Facility Appendices to the QAMP within their region
- Responsible for assessing and maintaining the QAMP within regional operations
- Responsible for assuring and improving quality within regional operations
- Assists in maintaining regulatory analytical compliance
- Supervises and provides guidance and training to laboratory QA staff
- Suspends processing when quality requirements are not met.

1.4.5 Quality Assurance Manager

- Reports directly to the Regional Director of Quality Assurance and indirectly to the Laboratory Director; serves as a member of the laboratory management team
- Approves the Facility Appendix to the Quanterra QAMP
- Responsible for assessing and maintaining the QAMP within the facility operations
- Responsible for assuring and improving quality within facility operations
- Recommends resolutions for ongoing or recurrent nonconformances within the laboratory
- Supervises and provides guidance and training to laboratory QA staff
- Suspends sample processing when quality requirements are not met
- Assists in maintaining regulatory analytical compliance
- Serves as the in-house client representative on all project inquiries involving data quality issues
- Reviews data quality measures including statistical data to verify that the laboratory is meeting stated quality goals
- Performs QA assessments as described in Section 9.0
- Closes findings of QA audits
- Serves as the focal point for the reporting and disposition of nonconformances
- Assists in the preparation of and approves Quality Assurance Project Plans (QAPjPs)
- Maintains laboratory certification and accreditation programs
- Maintains controlled quality documents
- Prepares a monthly quality report to management
- Responsible for reference data maintenance on QuantIMS.

1.4.6 Vice President of Quality and Productivity

- Reports directly to the Senior Vice President of Operations Services
- Approves the Quanterra QMP
- Responsible for implementation of an effective quality management system and quality improvement program
- Monitors quality improvement programs
- Recommends improvements in operations and quality programs
- Provides feedback regarding customer satisfaction
- Provides resources for training.

1.4.7 Other Vice Presidents and Corporate Directors

- Responsible for implementing the Quanterra QMP requirements for their areas
- Brings quality-related problems to the attention of the appropriate management, the Vice President of Quality and Productivity, and the Corporate Director of Quality Assurance
- Secures resources for the resolution of quality-related problems.

1.4.8 Client Service Directors and Managers

- Defines customer requirements through project definition
- Assesses and assures customer satisfaction
- Provides feedback to management on changing customer needs
- Brings together resources necessary to ensure customer satisfaction.

1.4.9 Vice President and General Manager of Laboratory Operations

- Reports directly to the President and CEO
- Responsible for implementing the Quanterra QMP within their region
- Approves and implements the Quanterra QAMP
- Assigns specific responsibilities within operational units to resolve quality-related problems in their regions
- Maintains a dialogue with the Vice President of Quality and Productivity and the Corporate Director of Quality Assurance
- Determines the effectiveness of the Quanterra QMS in their region.

1.4.10 Laboratory Director

- Reports directly to the Vice President and General Manager of Operations
- Responsible for implementing the QMP and QAMP within the laboratory
- Approves the Facility Appendix to the QAMP
- Periodically determines the effectiveness of the QAMP within the operation
- Maintains adequate staffing documented on organization charts.

1.4.11 Operations Manager

- Reports directly to the Laboratory Director
- Supervises daily activities of the Operational Groups
- Supervises QC activities performed as a part of routine analytical operations
- Implements data verification procedures

- Supervises the preparation and maintenance of laboratory records
- Supervises maintenance of instruments and scheduling of repairs
- Works with the Systems Manager and Group Leaders to assure the requirements of projects are met in a timely manner
- Responsible for meeting quality requirements.

1.4.12 Systems Manager

- Reports directly to the Laboratory Director
- Supervises daily activities of the Project Management, Sample Control, Administrative, and Report Production Groups
- Works with the Operations Manager and/or Group Leaders to assure the requirements of projects are met in a timely manner
- Responsible for meeting quality requirements.

1.4.13 Project Manager

- Monitors analytical and QA project requirements
- Prepares Quality Assurance Summaries (QASs)
- Assists the laboratory staff with interpretation of work plans and QAPjP requirements
- Reviews data packages for completeness and compliance to client needs
- Keeps the laboratory and client informed of project status
- Together with the QA Manager, approves customer requested variances to methods
- Monitors, reviews, and evaluates the progress and performance of projects
- Reports client inquiries involving data quality issues or data acceptability to the facility QA Manager
- Conducts project reviews to assess the laboratory's performance in meeting customer requirements
- Responsible for meeting quality requirements.

1.4.14 Group Leader or Team Leader

- Reports directly to the Operations Manager (or the Laboratory Director in the absence of an Operations Manager)
- Supervises daily activities of analyses within the group
- Supervises QC activities performed as a part of routine analytical operations
- Implements data verification procedures
- Supervises the preparation and maintenance of laboratory records

- Evaluates instrument performance and supervises the calibration, preventive maintenance, and scheduling of repairs
- Oversees or performs review and approval of all analytical data
- Reports nonconformances to the appropriate managers
- Responsible for meeting quality requirements.

1.4.15 Analyst

- Performs analytical methods and data recording in accordance with documented procedures
- Performs and documents calibration and preventive maintenance
- Performs data processing and data verification procedures
- Reports nonconformances to the Group Leader and QA Manager
- Responsible for meeting quality requirements.

1.4.16 Sample Custodian

- Ensures implementation of proper sample receipt procedures, including maintenance of chain-of-custody
- Reports anomalies associated with condition-upon-receipt to the Project Manager
- Logs samples into the Quanterra Information Management System (QuantIMS)
- Ensures that all samples are stored in the proper environment
- Assists Environmental Health and Safety staff with sample disposal
- Responsible for meeting quality requirements.

1.4.17 Report Production Staff

- Accurately generates or compiles the analytical reports and associated deliverables for delivery to the client
- Responsible for meeting quality requirements.

2.0 Quality System and Description

Quanterra has defined Quality as meeting the requirements of our clients, both internal and external. The QMS provides the structure to achieve the total quality management goals necessary to obtain world class standards of performance and quality in all areas.

2.1 Quality Management System

The purpose of the QMS is to ensure the quality of products and services. The QMS is a structured management system of principles, objectives, policies, responsibilities, and implementation plans at the organizational and project-specific levels. At the organizational level, the QMS provides the framework within which project-specific planning, implementation, and performance assessment may occur. The QMP describes both the organizational and project-specific principles, goals, controls, and tools of the QMS. The document is divided into functional area chapters such as procurement, training and qualification, and information systems. The QMS is described in more detail in this QAMP, department plans, quality documents, and corporate SOPs.

The QMS steering committee, comprised of the Quanterra President and CEO and his staff, establishes the QMS mission and its strategic plan, and provides leadership and support for the achievement of all quality goals and objectives. It is the responsibility of all Quanterra directors and managers to implement the QMP mission by setting goals and objectives which lead to the achievement of the Quanterra mission.

2.2 Quality Assurance

QA involves a system of activities which ensures a process, product, or service meets the needs and expectations of the customer. QA is an integral part of Quanterra's QMS.

The organizational and project-specific systems of the Quanterra QMS, discussed in Section 2.1, are used to define QA goals. Controls at the organizational level regulate activities that support common or standardized functions such as associate qualifications and training, document control, and material procurement. Controls at the project level regulate the definition and implementation of customer requirements to produce the desired type and quality of product. Some specific examples of quality controls are:

- Measuring lab and instrument performance on a daily basis
- Demonstrating lab capability through data quality assessments which document the overall qualification of the laboratory to perform environmental analyses
- Utilizing SOPs to ensure consistency in the measurement process

- Providing controlled flexibility in routine methodology to meet specific sample and data requirements
- Monitoring operational performance of the laboratory on a routine basis and providing corrective action if needed
- Recognizing and promptly correcting any factors which adversely affect quality
- Maintaining complete records of sample receipt, laboratory analysis, data verification, reporting, and sample disposal.

2.3 Quality Documents

The QMS is defined by a series of documents which are described in Sections 2.3.1 through 2.3.6. The review and control of these documents are described in Section 5.0.

Following is a list of documents used to develop Quanterra's QMP and QAMP. The requirements of several of these documents are cross-referenced with the content of the QMP and QAMP in Table 2.3-1.

- Interim Draft EPA Requirements for Quality Management Plans, U.S. Environmental Protection Agency, EPA QA/R-2, July 1993
- Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs, American Society for Quality Control, Energy and Environmental Quality Division, Environmental Issues Group, ANSI/ASQC E4-19xx (Formerly EQA-1), January 1994
- Quality Assurance Program Requirements for Nuclear Facilities, The American Society of Mechanical Engineers, ASME NQA-1-1989 edition
- Quality Assurance, Office of Nuclear Energy & Office of Environment, Safety, and Health, United States Department of Energy, DOE ORDER 5700.6C, August 21, 1991
- Performance Criteria for Radiobioassay, ANSI N 13.30, September 1989
- Measurement Quality Assurance for Radioassay Laboratories, ANSI N 42.2, Revised May 21, 1992, Revision 10A
- Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing, American Society for Quality Control, ANSI/ASQC Q91-1987
- Guidelines and Specifications for Preparing Quality Assurance Program Plans, QAMS-004/80, Office of Monitoring Systems and Quality Assurance, Office of Research and Development, U.S. Environmental Protection Agency, September 1980
- Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, Office of Monitoring Systems and Quality Assurance, Office of Research and Development, U.S. Environmental Protection Agency, EPA 600/4-83-004, February 1983.

2.3.1 Quality Management Plan

The QMP describes the QMS. It is applicable to all Quanterra operations and provides direction to both administrative and technical areas. The QMP has precedence in internal policy matters over all other Quanterra quality-related documents.

2.3.2 Quality Assurance Management Plan for Environmental Services

This Quanterra Quality Assurance Management Plan for Environmental Services (QAMP) supplements the Quanterra QMP and provides additional criteria and specifications for the generation of environmental analytical data. The QAMP, along with Quality Policy Documents and SOPs, describes the implementation of the QMP within the laboratory. The QAMP provides QC criteria for standard procedures and facility-specific certification, instrumentation, and method detection limit (MDL) information.

2.3.3 Quality Policy Documents

Quality Policy Documents provide further detail to the QMP and QAMP. They describe the requirements for a specific program on a corporate-wide level. Quality Policy Documents use the concepts and requirements contained in the QMP and QAMP and provide sufficient detail so that corporate or facility-specific SOPs can be written.

2.3.4 Standard Operating Procedures

Standard Operating Procedures (SOPs) describe how requirements contained in the QMP, QAMP, Quality Policy Documents, regulatory methods, client contracts, and QAPjPs are executed. In addition, there are SOPs which relate to other support services performed in the company. In general SOPs will be corporate or operation-specific. Corporate SOPs specify procedures that are standard across Quanterra. Operation-specific SOPs detail procedures that pertain to that operation only. SOPs specify procedures, methods, corrective action requirements, documentation, review, and verification requirements.

2.3.5 Quality Assurance Project Plans

Regulations and contracts sometimes require quality programs which are different from Quanterra's QAMP and QMP. To address unique or modified requirements, Quality Assurance Project Plans (QAPjP) may be prepared and implemented. The requirements documented in a QAPjP take precedence over the Quanterra QAMP for that work.

If requested and approved by the client, project-specific requirements may be less stringent than the Quanterra quality program. The Quanterra Corporate QA staff will be notified of these QAPjPs. Typical specifications contained in a QAPjP include:

- New or modified testing methods
- Unique QC logic
- Special requirements for equipment use and maintenance
- Special handling due to safety considerations

- Project-specific detection and reporting limits
- Project-specific accuracy and precision limits or the statistical treatment of data
- Additional or unique documentation or records management requirements.

2.3.6 Other Documents

Other documents which can affect the quality program may include the Chemical Hygiene Plan (CHP), the Compliance Program Plan, memos, guidance documents, and reports. These documents may further define or guide the implementation of quality standards at Quanterra but shall not conflict with the QAMP or diminish the effectiveness of the QMS.

3.0 Associate Training and Qualification

All activities performed by Quanterra shall be accomplished by qualified associates. The following definitions are relevant to the discussion of associate qualification and training presented in this section:

- Qualification - The characteristics or abilities gained through training or experience or both, that enable an individual to perform a required task.
- Orientation - The act or process of acquainting individuals with an existing situation, environment, or condition.
- Training - In-depth instruction to develop proficiency in the application of requirements, methods, and procedures. Instruction may be internal or external classroom sessions, courses, or on-the-job training.
- Certification - The action of determining, verifying, and attesting, in writing, to the qualifications of associates.

3.1 Associate Qualifications

Each operating unit shall have job descriptions for all positions. These job descriptions must specify the minimum qualifications for education and experience, knowledge, and skills which are necessary to perform at a satisfactory level. An associate's performance shall be compared with the requirements of his/her job description at least annually, in conjunction with the associate's annual performance review.

Quanterra expects the necessary knowledge, experience, and skills to be demonstrated by formal academic training. For associates involved in laboratory work, this includes coursework such as general chemistry, qualitative analysis, quantitative analysis, and instrumental analysis. Qualifications of professional associates shall be documented by resumes which include academic credentials, employment history, experience, and professional registrations. A copy of the resume will be placed in the associate's training file.

3.2 Orientation and Training of Laboratory Staff

Associates receive internal, external, formal, and informal training. Training is performed to maintain and develop proficiency, and to promote improvement. Training is performed by individuals knowledgeable in the subject matter.

Quanterra associates are qualified using the experience and training documented in their training files, and are assigned duties within their experience and training. Each new associate shall receive orientation and training in quality and health and safety. Each new associate shall also be supervised in their activities by experienced associates until, in the opinion of their supervisor, they are capable of independently performing their duties. The authorization to perform independently shall be documented in the training files. In addition, training for associates shall include professional, managerial, communication, and interpersonal skills. On-going or periodic assessments will be performed to determine training needs and effectiveness of instruction.

3.2.1 Quality Orientation

Each newly hired Quanterra associate, whether full-time or part-time, receives a Quality orientation. The QA Manager shall conduct this orientation within two weeks of the associate's report-to-work date. This orientation will be documented in the associate's training file. The QA Manager shall review the following topics (at a minimum) with the new associate:

- Quanterra quality documents including the Quanterra QMP and QAMP
- Quanterra policies on data integrity, meeting client requirements, and ethics
- Pertinent regulatory requirements
- Proper data recording practices
- Nonconformance and corrective action procedures.

The associate is required to take a written examination to demonstrate an understanding of the Quality orientation and to determine if any areas covered require further training.

3.2.2 Quality Training

Continued training in the nature and goals of the QMP shall be provided at least once per year. Formal training sessions are conducted and documented by the QA Manager. The training program shall address relevant regulatory requirements, basic QC practices, responsibilities of the technical and QA staff, the reporting of nonconformances, and the audit process.

In addition, each Quanterra associate shall become familiar with the operating unit's quality programs by reading the relevant sections of the Quanterra QMP, QAMP, policies, and SOPs pertinent to his/her position.

3.2.3 Health and Safety Orientation and Training

Each newly hired Quanterra associate, contract worker, or working visitor is required to go through health and safety orientation and training as per the laboratory Chemical Hygiene Plan (CHP). The orientation must be performed as soon as possible after the associate's report-to-work date and before chemicals are handled. Quanterra associates and contract workers shall be given comprehensive health and safety training within

90 days of the start-to-work date. Documentation is maintained in the associate's training file.

3.2.4 QA Manager Training

All QA Managers shall receive training so that they are proficient in the requirements of the Quanterra QMP and QAMP. Training, directed by the corporate QA staff, is performed on an annual basis. Continued proficiency of QA Managers shall be maintained through active participation in QA audits and the preparation and review of QA documents.

3.3 Training Files

Each Quanterra associate has an individual training file maintained by the QA office or a facility training administrator. The categories of training documents included in the training file are the following:

- Associate's resume
- Quality Assurance
- Safety
- Technical
- Professional Development
- Regulatory

Information is filed in the training file as training is received. Not all associates will have training records for all areas depending upon their job function or tenure with the company.

Each associate shall review their training file annually, at a minimum, to ensure completeness and accuracy of the information.

3.3.1 Associate Resumes

A copy of the associate's current resume will be placed in the associate's training file. Qualifications of associates include academic credentials, employment history, experience, and professional memberships and registrations.

3.3.2 Individual Training Records for the Areas of QA, Safety, and Technical

Training of each associate shall be summarized and documented on individual training forms. These include documentation of participation in orientation training, one-on-one training, or participation in classes and other presentations, and any other formal training sessions, either internal or external. Examples of some of the forms used to document this training are provided in Figures 3.3-1 to 3.3-3. Technical training records shall include documentation of laboratory certification of the ability to perform sample preparation or analysis. In addition, if any tests are given as part of the training in each of these areas, the results are filed in the individual's training file.

FIGURE 3.3-1
Example New Employee Quality Orientation Form

Name: ______________________ Date of Hire: ______________________

Job Title: ______________________ Report to Work Date: ______________________

QUALITY ASSURANCE PROGRAM SECTION	REVIEW (X)
Statement of Management Position concerning Quality	________
Quanterra Quality Management Plan (QMP)	________
Quanterra Quality Assurance Management Plan for Environmental Services (QAMP)	________
Data Recording Practices	________
Nonconformance and Corrective Action	________
Quality-Related Responsibilities for Job Title (Section and/or Topic):	________

____

I attended the session covering QA sections and/or topics as described above and understood the material presented during the session.

______________________ ______________________

Associate's Signature Date

______________________ ______________________

QA Manager's Signature Date

QA Exam Given? ________ Orientation was adequate ________ Further training is needed ________

Follow-up sessions covered:

____

____

______________________ ______________________

Associate's Signature/Date QA Manager's Signature/Date

THIS DOCUMENT MUST BE RETAINED IN THE ASSOCIATE'S TRAINING FILE

FIGURE 3.3-2
Example One-On-One Cross-Training Tracking Form

This hourly tracking form is designed to record formal training hours that an individual receives at the bench from a qualified trainer. Please provide as much information in each heading as possible.

Trainee Name ____________________ Trainer Name ____________________

Week of: ____________________

Day	Date	Hours	Topic	SOP #	METHOD

Will training continue?________ Date________

Trainer signature:____________________________________

THIS DOCUMENT MUST BE RETAINED IN THE ASSOCIATE'S TRAINING FILE

FIGURE 3.3-3
Example Employee Record Of Training

Employee Name (print)_______________________________ Date: _______________

Dept/JobTitle:____

Course Title:____________________________________ Course Code:__________

Description:____

Instructed by:____

I have received and completed the training described below. This training included the following:

Instructor Signature *Employee Signature*

THIS DOCUMENT MUST BE RETAINED IN THE ASSOCIATE'S TRAINING FILE

3.3.3 Training Records for Professional Development

This category includes documentation of all courses taken relating to an individual's professional development. Courses may include: Conflict Resolution, Time Management, Conducting Effective Meetings, Interviewing Skills.

3.3.4 Training Records for Regulatory Information

This category provides for documentation of training on topics required by law (with the exception of safety documented previously). Examples are: Sexual Harassment, Drug-Free Workplace, etc.

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4.0 Procurement of Items and Services

This section defines the Quanterra requirements for the procurement of items and services. Controlling the quality of items and services procured by Quanterra will help us meet the needs of our customers. The Quanterra procurement program requires:

- Assurance that purchased items and services meet Quanterra-established requirements and perform as expected
- Definitions and descriptions of the documentation levels required for the applicable technical and administrative requirements
- Evaluation and qualification of vendors

4.1 Selection of Vendors

Prospective vendors are selected based upon criteria appropriate to the materials or services provided. For national vendors and contracts, the vendor is selected through either a competitive proposal/bid process, strategic business alliance or negotiated vendor partnership. Vendors are evaluated on the following criteria as appropriate:

- The vendor's history of providing identical or similar products that perform satisfactorily in actual use
- The vendor's service record and ability to provide a complete product line and commensurate service
- The vendor's ability to administer inventory at Quanterra facilities through a fully developed inventory management system that will ensure correct stocking levels as well as shelf-life tracking
- Software systems that will integrate with Quanterra systems
- The vendor's demonstrated effectiveness in implementing Total Quality initiatives
- Objective evaluation of the vendor's current quality records supported by documentation
- Ability of the vendor to provide service agreements for instruments that meet Quanterra specifications
- Evaluation of the vendor's business strategy and the ability of that strategy to complement Quanterra's mission
- Results of audits by Quanterra of the vendor's technical and quality capability.

A Quanterra quality representative shall determine the appropriate level of evaluation criteria for the item or service being purchased. Vendors that provide test and measuring equipment, solvents, standards, instrument-related service contracts, or subcontracted laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items. For the procurement of testing and measuring equipment it is recognized that the environment in which the measurement system is placed may have a bearing on its performance. Therefore, in lieu of other supplier qualification activities, the quality representative shall ensure that an acceptance testing plan is in place to ensure that the measurement system is able to meet specifications in the intended operating environment.

4.2 Procurement of Quality-Related Items

The quality of instruments, equipment, standards, reagents, solvents, other chemicals, gases, water, and laboratory containers used in analyses must be known so that their effect upon analytical results can be defined. Quality-related items (QRIs) are items that are used in the operational unit that must meet a minimum quality requirement. All QRIs purchased by Quanterra operating units shall be evaluated to ensure that they meet the requirements and specifications established by Quanterra. These requirements and specifications include, but are not limited to, client contracts, project-specific quality assurance requirements, data quality objectives and analytical method requirements, and defined technical specifications.

Quality specifications shall be included or referenced in the purchasing documents for the procurement of the applicable items. The quality representatives, in conjunction with the procurement team, shall approve items purchased. This approval shall be maintained by Purchasing as a "Quality Approved" list of items. If items which may affect laboratory quality are requested from non-preapproved vendors, quality approval must be obtained prior to placing the order.

When ordering quality related items, a system shall be put in place to verify the quality of the item received. Each laboratory shall assign individuals responsible for material procurement and control. Duties include:

- Specifying, in purchase orders or requisitions, suitable grades of materials (grade shall be defined by the responsible manager and detailed in SOPs)
- Verifying upon receipt that materials meet requirements (see section 4.2.3) and that, as applicable, material certificates are provided and maintained
- Identifying and storing materials
- Verifying that materials storage is properly maintained, and removing materials from use when shelf life has expired.

4.2.1 Role of Quanterra Purchasing

Quanterra Purchasing supports the laboratory by:

- Maintaining, issuing and negotiation contracts
- Identifying potential vendors and subcontractors
- Identifying vendors for unique or scarce materials
- Maintaining a system to facilitate purchases made by each facility
- Maintaining lists of available items through catalogs or contract agreements with approved vendors
- Preparing and communicating corporate policies regarding purchasing and procurement
- Developing and implementing a review of the purchasing program as it pertains to procurement of QRIs

In order to enhance the quality and consistency of the product within the laboratory network, the Director of Purchasing shall pursue national contracts for laboratory supplies, standards, and instruments of known quality and proven reliability.

4.2.2 Procurement Procedures

The specifications for standards, chemical reagents, solvents, gases, water and other QRIs shall be documented in SOPs. In addition, each laboratory must have SOPs that cover:

- Checking purity of standards, reagents, water and other chemicals as appropriate versus intended use
- Preparation, storage and expiration of standards, reagents and other chemicals as appropriate
- Requirements for lab containers (e.g., volumetric glassware, sample containers)

Corporate SOPs will be developed for these processes where appropriate. Operation-specific SOPs shall be in place if a corporate SOP does not exist.

Corrective actions for failure of an item to meet required specifications are:

- Review current supplies and eliminate from use; this must include communication to the Quanterra laboratory network and corporate purchasing to avoid additional problems in other facilities
- Return to vendor
- Evaluate a new lot or alternate supplier
- Evaluate the impact on product or process

The Corporate Director of Technology, Director of Purchasing, or the Corporate Director of Quality Assurance shall be notified promptly of any quality problems with national vendors.

4.2.3 Evaluation of QRIs

Most QRIs will be evaluated as a function of the standard analytical process. This involves the analysis of method blanks, as well as other QC samples as described in Section 8.0. For some QRIs, small variability in the item will significantly affect analytical results. For these QRIs the analysis and evaluation must take place prior to using the item. A corporate SOP shall be issued to describe the testing procedures and acceptance criteria. A list of QRIs that require testing prior to use is listed in Table 4.2-1. If any QRI is determined during routine use to be the source of quality problems, or has demonstrated variability that affects analytical results, the QRI may be added to the list in Table 4.2-1. Facility Quality Assurance Managers must forward such requests to the Corporate Director of Quality Assurance, the Director of Purchasing, and the Corporate Director of Technology.

For items that are used regularly by Quanterra facilities where no unique requirements or specifications are required, the items may be purchased off-the shelf. These items are ordered from the supplier on the basis of specifications set forth in the suppliers published product description. Off-the-shelf items include general laboratory supplies such as glassware, filter paper, pipettes, and chromatography columns. These items are evaluated as a function of the standard analytical process. An off the shelf item can be added to the list in Table 4-2.1 when it is determined that evaluation prior to use is required. Requests to add items to this list are made to the facility QA Manager.

Evaluation of instruments purchased shall be conducted according to the acceptance testing plan as established in the procurement documents. Acceptance criteria may include instrument reliability, sensitivity, stability, accuracy, and ability to interface with existing computer systems and networks.

4.2.4 Special Requirements for Standard Reference Materials

For all standard reference materials (standards), Quanterra will use materials of known quality for the intended use. Where available, standards will be traceable to the National Institute of Standards (NIST). If the NIST traceability is not commercially accessible, the best available standard for the material or isotope shall be used. Certificates for Certified Reference Materials (CRMs) shall be procured from the supplier. Documentation received with each standard shall include the following information as appropriate:

- Traceability to NIST (where available) or other certificate of analysis
- Radionuclide identification with activity and error
- Reference Material Certificate
- Certification Report that will include pertinent information such as:
    - Starting material characteristics including purity
    - Expiration date
    - Lot number
    - Preparation date
    - Methods of measurement and associated uncertainty
    - Actual weights and measurements determined by gravimetric or volumetric measurement
    - Unique identifying number
    - Formula weight
    - Density
    - Half-life of radionuclide(s)
    - Mass and volume of standards
    - Percent of impurities.

Receipt, storage, evaluation, use, control, and disposal of all standards as well as documentation of these activities are described in operation-specific SOPs. Additional discussion of standards can be found in section 8.5.4 of this document.

4.3 Procurement of Subcontract Laboratory Services

A subcontract laboratory is defined, for the purposes of this QAMP, as a laboratory external to the Quanterra laboratory network. A subcontract laboratory will be used only in the event that either Quanterra laboratories do not have the capability or capacity to perform the requested testing, or the customer so directs. A subcontract laboratory shall be used only after approval is obtained from the client and the quality of the laboratory is determined to be acceptable. Once these conditions are met, the subcontract laboratory will be added to an approved subcontractor list maintained in a database.

When it is determined that a subcontract laboratory is required and approval is obtained from the client to use a laboratory external to the Quanterra network, the QA Manager must assess the selected subcontract laboratory. This assessment must be approved by the Corporate Director of Quality Assurance and documented at the Quanterra laboratory that will be subcontracting the work.

A procedure will be in place for requesting that a subcontract laboratory be added to the approved list. In addition, subcontract laboratories may be removed from approved status for failure to perform adequately, as a result of audit findings or at the request of the Corporate Director of Quality Assurance.

4.4 Vendor Partnerships

Quanterra may enter into partner agreements with vendors under the auspices of the technology organization. The purpose of these vendor partnerships is to standardize instruments, data handling systems, and other products or services which enable or enhance our ability to meet or exceed the requirements of our clients. Vendor partnership agreements must meet the requirements in Section 4.1 of this QAMP.

5.0 Documentation and Records

5.1 Quality Documents and Records

Quality documents are those which define the objectives, policies, and procedures that ensure the quality of items and services provided by Quanterra. A system has been designed to revise, distribute, and control quality documents. Quanterra quality documents are listed in Table 5.1-1 along with their approval requirements.

Records are completed documents that provide objective evidence of an item or process. Records are discussed in Sections 5.4 through 5.6.

5.2 Document Review and Revision

Quality documents have multiple levels of review and approval appropriate for the document. These reviews are demonstrated by the signature of the reviewer on the document. Quality documents are required to be periodically reviewed and, if necessary, revised. The frequency of this review is dependent upon the type of document and upon regulations and client requirements. In addition to periodic review and revision, quality documents must be revised when the activity, policy, or procedure they describe changes in a significant manner. Table 5.2-1 lists the Quanterra quality documents along with their required frequency of reviews and the parties responsible for performing those reviews.

5.3 Document Control and Distribution

Document control is necessary to ensure that associates have access to current polices and procedures at all times. Quality documents that are placed under a controlled distribution include, but are not limited to the QMP, QAMP, Quality Policy Documents, and SOPs. QAPjPs are also placed under a controlled distribution when that document is generated by Quanterra.

Quality documents are controlled by initially distributing them to the associates who need to be aware of or follow the contained information or procedures. All subsequent revisions or updates to the document are also distributed to the associate. A controlled copy distribution list is maintained with the name of each associate who received a copy along with their controlled copy number. Records of controlled distribution are maintained by Quanterra and demonstrate that current policies and procedures have been issued to all appropriate personnel.

Controlled documents are marked "Controlled Copy" and are numbered according to the controlled copy distribution list. Copies of documents placed under controlled distribution are sometimes released with the understanding that no further updates or revisions of that document will be issued to that individual document holder. Those copies are marked "Uncontrolled Copy" and are not numbered.

5.4 Records Management

Information for each business function of the organization is stored appropriately according to its type of information. Details of the records management program are contained in the Quanterra Record Retention Policy and supporting documents.

Quanterra is committed to providing scientifically sound, legally defensible data of known and documentable quality. Legally defensible data are data which will stand against reasonable adversarial inquiry. Data must be supported by a QAPjP, client agreements, or the Quanterra QMP and QAMP. Data must also be documented so that the analytical process can be reconstructed. Project files must be organized so that the project events can be reconstructed if necessary. Accountability for the completeness and accuracy of information must be specified. Supporting information, including data that demonstrates a facility's ability to perform specific analyses, shall be maintained.

Records are divided into two distinct types. Quality and operations records and project records are discussed in the following sections. Each laboratory shall have a system in place that provides for appropriate and adequate implementation of these records management requirements.

5.4.1 Quality and Operations Records

Quality and operations records demonstrate overall laboratory operation. Examples of quality and operations records are instrument logbooks, equipment calibration records, instrument calibration data, and control charts. These records may apply to one or more projects, but in general they are applicable to many projects. Quality and operations files must be indexed, labeled, and properly maintained.

5.4.2 Project Records

Project records are documents which are specific to a project or a group of samples within an ongoing project. Examples of project records include chain-of-custody forms, raw analytical data, project-specific nonconformance memos, project correspondence, and project reports. Project records are stored in project files. Each project file shall be indexed, labeled, and current.

5.5 Validation of Records

When records, as contained in files, are transferred to a records storage area, they shall be placed in suitable containers. Each container shall be verified by comparing its contents against an inventory sheet listing its contents. If there are any discrepancies, the container and inventory sheet shall be returned to the associate submitting the records for resolution.

5.6 Retention and Disposal of Records

Quanterra shall maintain and dispose of records according to the Quanterra Record Retention Policy.

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6.0 Use of Computer Hardware and Software

The purpose of defining controls for computer hardware and software is to protect the integrity of computer-resident data. SOPs shall be put in place to ensure that computer-resident data are accurate, defensible, and secure.

6.1 Use of Hardware

Computer equipment used in the generation, measurement, or assessment of client or business data shall be of appropriate design and of adequate capacity to function according to specifications. This equipment shall be suitably located for operation, inspection, cleaning, and maintenance. A written description of the computer system(s) hardware will be included. The computer shall be installed in accordance with the manufacturer's recommendations and shall undergo validation which demonstrates that the computer equipment correctly performs its stated capabilities and functions. Changes to computer hardware configuration shall be made only after review and approval of the Director of Information Services for each functional area.

Computer hardware shall be inspected, cleaned, and maintained on a regular basis. There shall be:

- SOPs for validation, maintenance, and security of hardware
- A designated associate to be responsible for system performance
- Written records of all hardware validations
- Written records of all maintenance
- A description and diagram of hardware configuration
- A written hardware problem log.

6.2 Security

Procedures shall be in place which secure computer hardware and software systems, if that system:

- Contains confidential information that requires protection from unauthorized disclosure
- Contains data in which the integrity must be protected against unintentional error or intentional fraud
- Is used to acquire, process, or report business or client data.

When a computer system contains data that must be secured, each laboratory shall ensure the system is physically secured, physical and functional access to the system is limited to authorized persons, and introduction of unauthorized external programs or software is prohibited.

6.2.1 Backup

Computer files will have back-up copies made at the following frequency as a minimum:

- LAN Systems - Weekly
- Data Aquisition Programs - Daily
- QuantIMS - Daily

Details of back-up procedures including retention periods for back-up media and storage requirements are described in SOPs.

6.3 Use of Software

If computer software is used to acquire, process, or report business or client data, it is necessary to demonstrate that the software correctly performs its intended function. The following definitions are important to this discussion:

- Validation - establishing documented evidence which provides a high degree of assurance that a specific process will consistently produce a product meeting predetermined specifications and quality attributes. This process demonstrates that the mathematical or statistical model embodied in the computer program is an acceptable representation of the process or system for which it is intended and meets all specified requirements.

- Verification - the process of checking the accuracy of manually or automatically (electronically) entered information.

In general, software is validated by comparing its performance against known results. Validation may be done in several ways (see Sections 6.3.1 and 6.3.2). There shall be SOP(s) describing each of the following:

- Software validation
- Data entry and verification
- Data change control
- Data analysis, processing, storage, and retrieval
- Backup and recovery of data and software
- Electronic reporting of data including on-line client access to data and reports
- Definition of and storage times for data and software.

Each laboratory shall maintain a record of software updates and upgrades, including operating system upgrades for all hardware, for both testing and production systems.

6.3.1 Industry Standard Software

Industry standard programs are defined as those which are widely used throughout the profession, brought into Quanterra, and used without modification. The program is validated for use on a Quanterra system by using example problems to demonstrate that the program is operational for the desired application.

All industry standard software must be used in accordance with its associated license and copying of software contrary to the licensing agreement is prohibited in Quanterra. All installed software shall be reviewed periodically with respect to licensing requirements.

6.3.2 Quanterra-Developed Software

For programs developed within Quanterra, and externally prepared programs which are modified by Quanterra, validation must be performed. The validation process is dependent upon the function of the software as follows:

- For software which only performs numerical manipulation, sample sets of numbers for which results are known should be processed and compared. In this case, known results are usually generated by performing hand calculations using the same equations and procedures as the software. Validation must test the software's production of the intended results. Problems must test both the theory, or basis for computation, and the ability of the software to store and manage data.

- Software which performs as part of instrument operation should be validated as previously described and by processing reference materials through the instrument system. Processed instrument response should be evaluated against expected instrument response and performance.

6.3.3 Control of Software Changes

Changes to software shall be controlled and detailed control procedures must be documented. Whenever a program is changed, validation is necessary. If the software has had features added, previous test problems should be rerun to demonstrate that their function has not been affected. New test problems should be processed, as previously discussed, to verify added performance. If software revision changes the basic operation of the program, complete reverification of the program is required.

6.3.4 Software Revalidation

Spreadsheets and unprotected software shall be revalidated on an annual basis. The test problems used to provide initial validation shall be reprocessed and the results compared to demonstrate that performance of the software is unchanged. If software performance has changed, the effect of the change upon intended function and usage since last verification shall be assessed and documented. The effect must be determined on a case-by-case basis for the scope and impact of incorrectly reported results. If necessary, the data shall be reprocessed and the recipients of affected data notified. Protected and controlled software programs must be validated upon creation or change and verified periodically.

6.3.5 Software Validation and Verification Documentation

Software validation and verification shall be documented by the associate performing the validation or verification by signing and dating the computer output and supporting calculations. If test problems are used, the input and output shall be checked to establish acceptable performance. If reference materials are used as the basis for validating instrument software, the reference material value and available certification shall be included with the output to demonstrate performance. The validation and verification documentation must be reviewed and approved by the associate's immediate supervisor and the Director of Information Services for each functional area.

All software validations, verifications, and reverifications shall be maintained in a file for that program. The file shall include the basis for the validation and verification, such as the test problems or hand calculations, results of the software performance, the results of revalidations, applicable program code, user manuals, technical documentation, a hardcopy of the program, and a copy of the program on diskette(s).

6.4 Computer Viruses

Quanterra operating units shall employ the use of anti-virus software to detect and remove viruses from secure computer hardware. Any suspicion of a software virus must be reported to the local and regional Information Systems (IS) Manager.

7.0 Planning

7.1 Introduction

The collection of environmental data is an intricate process. Success is dependent upon the timely execution of interrelated steps many of which may be project-specific. Quanterra works with its clients to plan projects. Technical and QA support ensure that data quality objectives can be met. Quanterra's clients will have a Customer Service Manager (CSM) and a Project Manager (PM) who can access and coordinate Quanterra's resources. Once project requirements are developed, Quanterra can document them in a QAPjP and work with clients to review it and obtain regulatory approval.

The sample collection and data generation processes are designed to produce analytical data that accurately reflect the nature of the site or sampling point. Figure 7.1-1 shows the sample collection and data collection process. To ensure our services meet client and project requirements, communication and planning with the client are emphasized. The organization described in Section 7.2 is in place to help achieve these goals.

7.2 Organization for Project Planning

The key project-planning units within Quanterra are the three business units: Federal Systems, Commercial Systems, and Advanced Technologies. The business units are separate from sales, marketing, finance and administration, quality, and technology. The vice presidents of the business units report directly to the President and CEO of Quanterra.

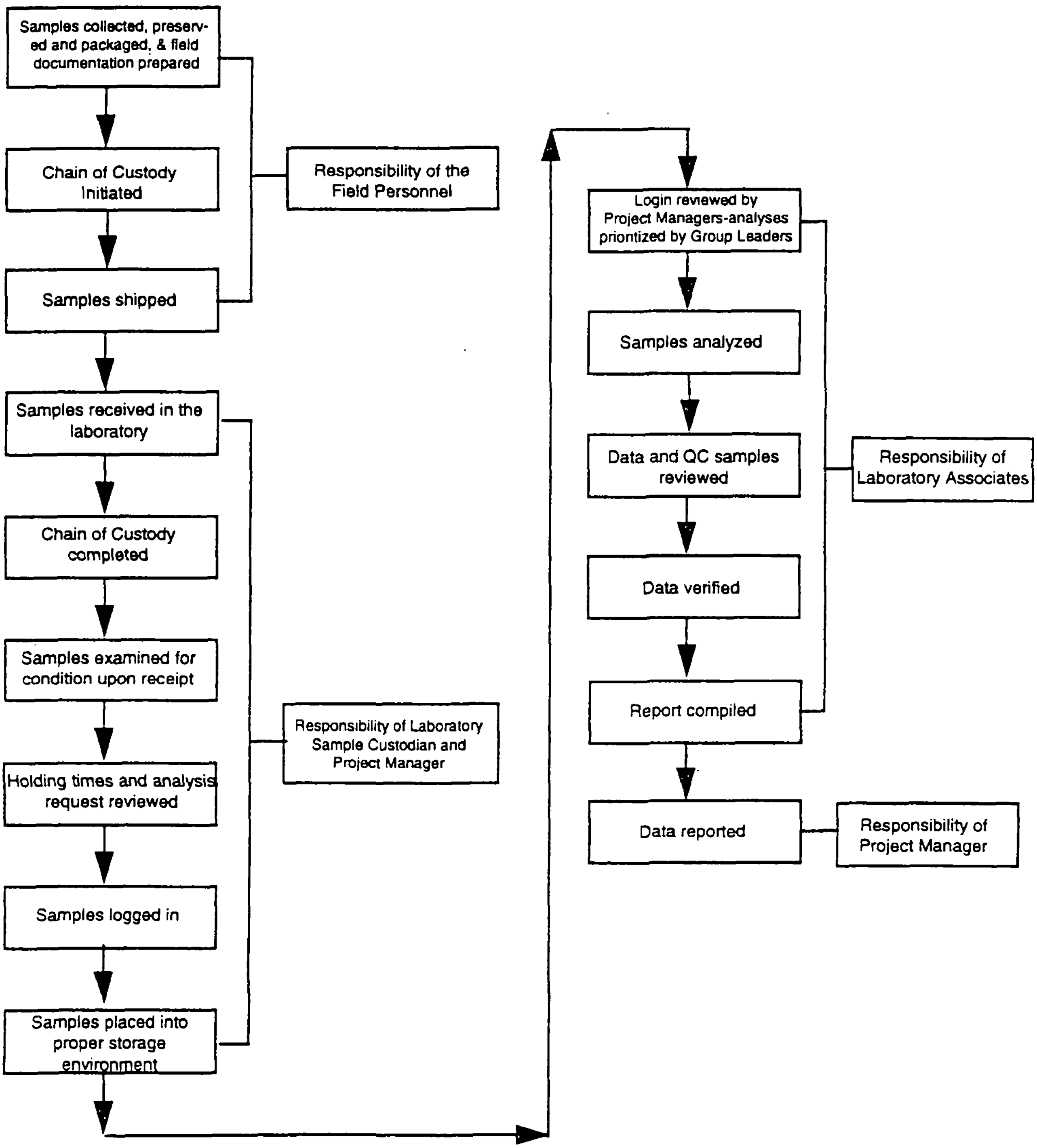
The business unit has responsibility for customer service, proposal preparation, and information services to address client-specific requirements. The operations and sales organizations have dotted-line responsibilities to the business unit. The business units receive additional support from the QA and technology organizations, PMs, and general operations personnel. The business units are national organizations, responsible to all clients and facilities.

7.3 Responsibilities

Planning successful projects is the responsibility of many associates from both the business operations and support units. The following sections address the typical responsibilities of each person. In some situations, the responsibility may change to ensure that client and project requirements are met.

FIGURE 7.1-1

Data Collection Process Flow Chart



There are several phases of large-project development: project qualification, specification, bid, final specification, order fulfillment, and client follow-up. Business unit personnel have lead roles in the initial and final phases of this process. PMs and other personnel have responsibility during the intermediate phases. Appropriately assigned lead roles ensure that:

- Unique project requirements are identified and assessed
- Standardized client, state, federal, or Quanterra programs are suitably used
- The capacity and specialties of Quanterra laboratories are optimized for the project
- Fully qualified subcontractor laboratories are used if needed.

7.3.1 Customer Service Team Responsibilities

The business units shall establish and maintain long term and substantive relationships with our clients, identify customer needs, and seek to attain value for our customers according to our customers' definitions. The business units create client-specific Customer Service Teams (CST). A CST may be formed at any time. A team may be created before any discrete projects exist, during on-going projects, or even after the completion of a project. The teams contain a core group of associates: a business unit CSM, an Account Manager, a facility-specific PM, a QA representative, and an IS representative. The team may also contain associates from the operations, technical, contracts, and/or accounting organizations. Table 7.3-1 shows some of the activities performed by the CST.

7.3.2 Operation-Specific Responsibilities

Associates, such as PMs, QA staff members, or technical staff, may became a member of the CST. Successful performance of a project requires planning at the facility level. The PM takes the lead role in implementation of project requirements at the laboratory

7.4 Quality Assurance Summary

Each operating unit shall use a Quality Assurance Summary (QAS) form to document all quality-related, client-specific and project-specific requirements. A QAS is completed by the PM or CSM for all projects prior to sample preparation and analysis even if an approved QAPjP is on file at the laboratory.

Each operating unit shall put into place a system that will ensure that the completed QAS is routed to all appropriate laboratory personnel prior to project participation.

The use of a QAS will ensure that all quality-related client and project requirements are identified and met. An example QAS is shown in Figure 7.4-1.

FIGURE 7.4-1 (Page 1 of 2)
Example Quality Assurance Summary

Client: ______
Project Code: ______
Contract Name: ______
Site: ______
Project Mgr: ______
Analysis Type: ___ Chemical ___ Rad

RAD SCREEN by:
____ Code
____ Client-Specific
____ Screens not needed

SAMPLE DISPOSAL:
____ Disposal by Lab
____ Return to Client
____ Archive

QAS No.: ______
Date Initiated: ______
Revision No.: ______
Date Revised: ______

ANY SPECIAL QC DOCUMENTS? ____ Yes ____ No

REPORTING

Report to Client:
____ Lab PQL
____ MDL/IDL/MDA
____ < Client DLs
____ Other: ______

QC Samples to be Reported:
____ BLK ____ MS
____ LCS ____ MSD
____ DUP
____ Other: ______

Report Type:
____ Certificate of Analysis
____ CLP
____ Other: ______

Report Grouping:
____ SDG
____ Chain-of-Custody
____ Analytical Batch
____ Other: ______

Report Deliverables:
____ No. of Hard Copies to:
____ Electronic Data Deliverable to: (Diskette Type: ______)
Client: ______
Address: ______
______
______
ATTN: ______

Report Deliverables:
____ No. of Hard Copies to:
____ Electronic Data Deliverable to: (Diskette Type: ______)
Client: ______
Address: ______
______
______
ATTN: ______

INVOICING

Invoice to:
Client: ______
Address: ______
______
______
ATTN: ______

Supporting Documentation:
____ Certificate of Analysis
____ RFA/COC
____ Screening Records
____ Other (list): ______
______

No. of invoices: ______
Special Instructions:
______
______
______
______

ADDITIONAL COMMENTS OR INSTRUCTIONS:
______
______

Project Manager's Approval: ______ Date: ______

FIGURE 7.4-1 (Page 2 of 2)
Example Quality Assurance Summary

Client: ______________________________
Project Code: ______________________________
QAS No.: ____________________ **Revision No.:** ____________

Number of Samples Expected by Matrix:
_____ Air (A) _____ Water (W)
_____ Soil (S) _____ Other (O): ____________________

Analysis/Product Code	Matrix (circle)	Method Prep/Analysis	QC Samples		Required Reporting Limit/Units/ Report as*	Holding Time (Days)	TAT** (Days)	Radiochemical-Specific	
			Type (circle)	Frequency				Count Time	Sample Size
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					
	A W S O		B LCS DUP MS MSD	per					

* A = "As Is" or D = Dry Weight Basis

**TAT = Turn Around Time

SAFETY HAZARDS: Chemical? ____ No ____ Yes: Define: ______________________________
Radioactive? ____ No ____ Yes:
Isotopes Expected: ______________________________ Rad Officer Approval (sign): ____________________

Special Instructions:

____
____

Comments:

____
____

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8.0 Work Processes and Operations

Much of the environmental project activity is planned and designed external to the laboratory or field operation and presented in the form of a contract, work plan, or Quality Assurance Project Plan (QAPjP). Laboratory and field activities are in turn planned, implemented, and assessed to meet client requirements according to approved procedures and methodologies. The QMP and QAMP provide the systems to document and implement these activities. The execution and assessment of the implemented operational systems are detailed in Quanterra corporate or operation-specific SOPs. The entire process is assessed on a regular basis for conformance to prescribed requirements.

Standard practices for Quanterra operations are detailed in this section. Specific project or program requirements which differ from those described here can be met. These must be in approved contracts, work plans or QAPjPs.

8.1 Standard Operating Procedures

SOPs are required in all Quanterra operating units for analytical and administrative activities from the receipt of samples in the laboratory through analysis, reporting, and subsequent sample disposition. Training, health and safety procedures, QC, method procedures, and instrument and equipment calibrations are included in SOPs. Standard SOP formats for all activities related to the generation and reporting of data are discussed in the Quanterra Quality Policy Document No. QA-001. SOPs shall be reviewed by technically qualified associates. SOPs are controlled documents and are distributed and maintained as described in this policy. SOP requirements for approval and frequency of review are given in Tables 5.1-1 and 5.2-1.

8.2 Analytical Methods

Whenever possible, Quanterra operations use industry and regulatory agency recognized analytical methods from source documents published by agencies such as the EPA, DOE, the American Society for Testing and Materials (ASTM), and the National Institute for Occupational Safety and Health (NIOSH) as described in Quanterra's SOPs.

All SOPs contain Quanterra's interpretation of the published methods. Significant modifications to the published method are described in the SOP. Operations are performed as described in these SOPs. Changes in procedure which may occur due to sample matrix or other events shall be documented in the project records.

8.3 Reporting Limits

In the environmental analytical chemistry literature, there are a variety of terms and acronyms used for expressing detection or quantitation limits. Method detection limits (MDL), as defined by USEPA 40 CFR, Part 136 Appendix B are determined annually for each matrix for all routine tests performed at Quanterra laboratories.

Two reporting limit conventions are used within Quanterra: the Standard Reporting Limit (SRL) and the Project-Specific Reporting Limit (PSRL). The SRL is a uniform, Quanterra-wide, reporting limit based on an evaluation of the Practical Quantitation Limits (PQLs) at Quanterra laboratories and the expected method performance in routine water and soil matrices. The PQL is the lowest concentration a method can reliably achieve within limits of precision and accuracy and is derived from empirical, matrix-free method performance studies. The Quanterra SRLs and PSRLs are maintained in the laboratory information management system database (QuantIMS).

PSRLs are used when project data quality objectives (DQO) require a reporting limit other than the Quanterra standard reporting limit. PSRLs tailor Quanterra's product to customer requirements.

Isotope dilution methods are reported with sample-specific detection limits.

For radiochemistry, whether the net result is negative, zero, or positive, the actual calculated result is reported with its associated propagated uncertainty. This reporting limit is affected by many factors, such as the length of count, chemical yield, half-life, background of the instrument, counting efficiency, and the matrix interference. The minimum detection limit for radiochemical analyses is defined as the smallest concentration of material that yields a net count above background with a 95 percent probability (a true signal is reported 95 percent of the time) and no greater than a 5 percent probability of calling a blank a true signal.

8.4 Quality Control Samples

Two types of Quality Control (QC) samples are field QC samples and laboratory QC samples. Field QC samples are collected during the sampling event and are useful in determining sampling precision and accuracy and monitoring for contamination that may occur during collection, transport or storage of environmental samples. Laboratory QC samples are routinely added at the laboratory to the normal sample stream. Successful analysis of these samples demonstrates that the laboratory is operating within prescribed requirements for accuracy and precision. In addition, utilizing matrix-specific laboratory QC samples, information regarding the effect of the matrix or field conditions on the analytical results can be obtained. The following sections describe common field and laboratory QC samples.

8.4.1 Field QC Samples

When field QC sample collection and analysis are required for a project, it is the responsibility of the project sampling supervisor to ensure that this sampling is performed correctly and at the project-required frequencies. Field QC samples may or may not be identified as such to the laboratory and are considered by the laboratory as field samples for the purpose of QC batching, sample preparation and analysis. Field QC sample results are reported in the same manner as actual field samples, unless a specific deliverable is requested by the client. No correction of the analytical data is done in the laboratory based on the analysis of field QC samples.

Field QC sample types, applicability to organic and inorganic analyses, precision and accuracy applications and by whom they are introduced are summarized in Table 8.4-1. The following sections provide descriptions of field QC samples.

8.4.1.1 Trip Blank

Volatile organics samples are susceptible to contamination by diffusion of organic contaminants through the septum of the sample vial. Trip blanks, also referred to as travel blanks, are analyzed to monitor for possible sample contamination during shipment. Trip blanks are prepared by filling two preserved VOA vials (with no headspace) with organic-free water. Trip blanks accompany the sample bottles during collection and shipment to the laboratory and are stored with the samples.

8.4.1.2 Rinsate Blank

A rinsate blank or equipment blank is a volume of rinse solution (deionized, distilled water or organic solvent) used to rinse a sampling tool. The rinse solution is collected after the sampling tool has been cleaned in order to demonstrate that there is no residual contamination remaining on the tool that would carry over into the next sample.

8.4.1.3 Field Blank

A field blank is a contaminant-free volume of water or soil that is provided by the sample collector to demonstrate the absence of contamination during sampling. Deionized, distilled water or previously-prepared solid material (e.g., Ottawa sand) is placed into sample containers by the sample collection crew, packaged, and shipped with the other field samples.

8.4.1.4 Field Duplicate

A field duplicate sample is a replicate taken from the same sampling event for that location. The field duplicate sample is submitted to the laboratory as a separate sample by the sample collection personnel. Results of field duplicate samples can provide a measure of sampling precision.

8.4.1.5 Field Matrix Spike

A field matrix spike sample is created by spiking target analytes into a sample in the field at the point of sample acquisition. These sample results provide information on the target analyte stability after collection and during transport and storage.

8.4.1.6 Collocated Samples

Collocated samples are independent samples collected in such a manner that they are equally representative of the variable(s) of interest at a given point in space and time. Examples of collocated samples include: samples from two air quality analyzers sampling from a common sample manifold or two water samples collected at the same time and from the same point in a lake.

Collocated samples processed and analyzed by the <u>same</u> organization provide intralaboratory precision information for the entire measurement system including sample acquisition, handling, shipping, storage, preparation, and analysis. Both samples can be carried through the steps in the measurement process together to provide an estimate of short-term precision for the entire measurement system. Likewise, the two samples, if separated and processed at different times or by different people, and/or analyzed using different instruments, provide an estimate of long-term precision of the entire measurement system. Collocated samples processed and analyzed by <u>different</u> organizations provide interlaboratory precision information for the entire measurement system.

8.4.1.7 Split Sample

A split sample is a sample divided into two portions. One portion is sent to a different organization or laboratory and subjected to the same environmental conditions and steps in the measurement process as the portion retained.

A split sample can be divided into portions at different points in the sampling and analysis process to obtain precision information on the various components of the measurement system. For example, a field split sample provides precision information about all steps <u>after</u> sample acquisition including the effects of storage, shipment, analysis, and data processing. Field split sample results may also reflect the degree of sample homogeneity.

Information on the intralaboratory precision of sample preparation and analysis steps of the measurement system is provided by samples split after they are received in the laboratory.

8.4.2 Laboratory QC Samples

Laboratory performance QC is required to ensure the laboratory systems (instrumentation, sample preparation, analysis, data reduction, etc.) are operating within acceptable QC guidelines (that is, are "in control") during data generation as required to meet the client's objectives. Laboratory QC samples consist of method blanks, instrument blanks, laboratory control samples and method-related calibration samples. In addition to laboratory performance QC, matrix specific QC is utilized to determine the effect of the sample matrix on the data being generated. Typically, this includes matrix spikes (MS), matrix spike duplicates (MSD), sample duplicates, and the use of surrogate compounds.

Laboratory and matrix-spike QC sample types are summarized in Tables 8.4-2, 8.4-3 and 8.4-4. In addition, Tables 8.4-5, 8.4-6 and 8.4-7 list laboratory QC samples, acceptance criteria and corrective actions by reference method for inorganic methods, organic methods, and the USEPA CLP Statements of Work respectively. The following sections provide descriptions of laboratory QC samples and their frequency of use. Criteria used for evaluation of QC sample results is given in Section 8.5. Reporting and archiving of QC data are discussed in Section 8.6.

8.4.2.1 Quality Control Batch

The QC Batch is a set of up to 20 field samples that behave similarly and are processed using the same procedures, reagents, and standards within the same time period. Included in the QC Batch is a Method Blank, Laboratory Control Sample (LCS) and Matrix Spike/Matrix Spike Duplicate (MS/MSD). Alternatively, a MS and sample duplicate may be used in place of the MS/MSD when described by the method or requested by the client. Field QC samples are included as discrete samples in the sample count. This definition of QC Batch is utilized by Quanterra unless there is clear regulatory guidance, contract specifications, or differing client requirements that are explicitly documented. Further details and requirements for the application of the definition of QC Batch are described in QA Policy Number QA-003.

8.4.2.2 Method Blank

The method blank is a QC sample that consists of all reagents specific to the method and that is carried through every aspect of the procedure, including preparation, cleanup and analysis. The method blank is used to identify any interferences or contamination of the analytical system that may lead to the reporting of elevated analyte concentrations or false positive data. Potential sources of contamination include solvent, reagents, glassware, other sample processing hardware, or the laboratory environment. In general, the method blank is a volume of deionized laboratory water for water samples, or a purified solid matrix for soil/sediment samples that is processed as a sample. In the event that no appropriate solid matrix exists, deionized water may be used. The volume or weight of the blank must be approximately equal to the sample volume or sample weight processed. A method blank shall be prepared with each group of samples processed.

8.4.2.3 Instrument Blank

The instrument blank is an unprocessed aliquot of reagent used to monitor the contamination of the analytical system at the instrument. System contamination may lead to the reporting of elevated analtye concentrations or false positive data. The instrument blank does not undergo the entire analytical process and generally consists of an aliquot of the same reagent(s) used for a sample dilution. Instrument blanks, referred to as continuing calibration blanks, are routinely applied in analyses for inorganic parameters.

8.4.2.4 Laboratory Control Sample

A laboratory control sample (LCS) is a laboratory generated sample beginning with a known and well characterized matrix that is fortified with target analytes. It is used to monitor the laboratory's day to day as well as ongoing performance of the applicable analytical methods. Day to day performance is characterized by the measure of the accuracy of the results. On-going monitoring of the LCS results provides evidence that the laboratory is performing the method within both acceptable accuracy and precision guidelines. The results of the LCS, used in conjunction with the matrix spike samples can provide evidence of whether the laboratory performed the method correctly or the sample matrix affected the results.

8.4.2.5 Matrix Spike

A matrix spike (MS) is an environmental sample to which known concentrations of target analtyes have been added. MS samples are analyzed to evaluate the effect of the sample matrix on the analytical methodology. MS samples are generated by taking a separate aliquot of an actual client sample and spiking it with the selected target analyte(s) prior to sample extraction. The

MS sample then undergoes the same extraction and analytical procedures as the unfortified client sample. Due to the potential variability of the matrix of each sample, these results may have immediate bearing only on the specific sample spiked and not all samples in the QC batch.

8.4.2.6 Matrix Spike Duplicate

A matrix spike duplicate (MSD) is a second aliquot of a sample that is spiked with the selected target analyte(s) and analyzed with the associated sample and MS sample. The results of the MS and MSD are used together to determine the effect of a matrix on the accuracy and within batch precision of the analytical process. Due to the potential variability of the matrix of each sample, the MS/MSD results may have immediate bearing only on the specific sample spiked and not all samples in the QC Batch.

8.4.2.7 Sample Duplicate

A sample duplicate is a second aliquot of an environmental sample (taken from the same sample container when possible) that is processed identically with the first aliquot of that sample. That is, sample duplicates are processed as independent samples within the same QC batch. The results are compared to determine the effects of the matrix on the precision of the analytical process.

8.4.2.8 Surrogates

Surrogates are organic compounds that are similar in chemical composition and behavior to the target analtyes but that are not normally found in environmental samples. Surrogates are added to all appropriate samples and QC samples being tested for organic analytes to monitor the effect of the sample matrix and the procedure on the accuracy of the process.

8.4.2.9 Analytical Spike

An analytical spike is created by spiking target analytes into a prepared portion (i.e., post digestion) of a sample just prior to analysis. It provides information on matrix effects encountered during analysis such as suppression or enhancement of instrument signal levels. It is most often used in elemental analysis involving various forms of atomic absorption spectroscopy. A single analytical spike serves as a single point application of the "method of standard additions".

8.4.2.10 Internal Standards

An internal standard is a compound or element with similar chemical characteristics and behavior in the analysis process to the target analytes, but is not normally found in environmental samples. The internal standard is usually added after sample preparation. The primary function of the internal standard is quantitation, however, it also provides a short-term indication of instrument performance.

8.4.2.11 Radiological QC Samples

Radiological QC samples and their frequency are listed in Section 7 of the QAMP facility-specific appendices when applicable.

The primary QC sample type used for radiological testing to monitor recovery is the yield monitor. There are two types of yield monitors: tracers and carriers. A tracer is a radioisotope, usually of the same element and having the same mode of decay as the analyte. A carrier is a non-radioactive solution added to assist in isolating the specific isotope of an element. When standardized, the carrier can also provide recovery information gravimetrically.

8.5 Data Collection Operations

Laboratory analyses are designed to produce data that are representative of existing conditions present at the time the sample was obtained. The data collection design includes field sampling events, sample handling and custody, analytical operations, data assessments, data verification, data reporting requirements and techniques to assess limitations of data use. These operations are discussed in Sections 8.5 through 8.8.

8.5.1 Field Collection and Shipment

In order to provide a sample that most accurately represents the test matrix, field sample collection personnel must abide by the sample collection guidelines and procedures established by involved regulatory agencies. A significant part of the efforts of regulatory agencies include the use of "approved" sample containers, chemical and physical preservation techniques, and observance of specified holding times. It is imperative that all samples be collected and preserved according to the appropriate analytical method specified in the QAPjP or QAPP (if one exists). Although the sampling may be performed by non-Quanterra personnel, the importance of sampling and transportation of the sample to the laboratory is understood and must be considered during data validation.

Sampling requirements <u>must</u> be communicated to the sampling team prior to field collection.

Field personnel are responsible for labeling each individual sample collected with the following information:

- Project number
- Unique sample number
- Sample location (including as appropriate: borehole and depth or grid coordinates)
- Sampling date and time

- Person(s) obtaining the sample
- Sample preservation
- Analysis required.

An overriding consideration for the resulting analytical data is the ability to demonstrate that the samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, laboratory custody, and disposal must be documented to accomplish this. Figure 8.5-1 shows an example Analysis Request/Chain-of-Custody (AR/COC) form that is used by the Quanterra laboratory network to document this evidence. Field personnel are responsible for initiating the AR/COC form.

The prompt shipment of samples to the laboratory is necessary to ensure that required holding times are met. Samples should be shipped by an overnight carrier, be hand-delivered, or transported in a manner that assures prompt delivery to the laboratory.

Some sites require an extensive radioactive screening process before a sample may be shipped. In these cases, it is imperative for the Project Manager to maintain good communications with the client to assure proper staffing of the laboratory in response to a decreased holding time.

Radioactive samples that are shipped to Quanterra operations must be screened upon receipt and found not to contain radioactivity that exceeds the level stated in the operation license of the laboratory. Samples received by a Quanterra facility containing radioactivity exceeding their license limit will immediately be returned to the project site.

8.5.2 Sample Containers, Shipping Containers, Preservatives, and Holding Times

8.5.2.1 Sample Containers

A sample container is defined as the sealed enclosure, usually made of plastic or borosilicate glass that the sample is collected in and stored in until analysis. All sample containers provided by Quanterra operations for environmental sampling are new and demonstrated to be clean for their appropriate use. All documentation certifying sample container cleanliness must be maintained in the operation's quality and operations files and can be provided to the client upon request. The sample containers to be supplied are listed in Tables 8.5-1 through 8.5-5. Sample containers provided to the client by Quanterra are transmitted under custody.

8.5.2.2 Shipping Containers

Shipping containers are defined as the sealed enclosure in which the sample containers are

FIGURE 8.5-1

Example Quanterra Analysis Request/Chain-of-Custody Form

Quanterra
Environmental Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
(615) 588-6401

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 2220
Page 1 of ____

Project Name/No. 1 ________
Sample Team Members 2 ________
Profit Center No. 3 ________
Project Manager 4 ________
Purchase Order No. 6 ________
Required Report Date 11 ________

Samples Shipment Date 7 ________
Lab Destination 8 ________
Lab Contact 9 ________
Project Contact/Phone 12 ________
Carrier/Waybill No. 13 ________

Bill to: 5 ________
Report to: 10 ________

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Pre-servative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22

Special Instructions: 23

Possible Hazard Identification: 24
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: 25
Return to Client ☐ Disposal by Lab ☐ Archive (mos.)

Turnaround Time Required: 26
Normal ☐ Rush ☐

QC Level: 27
I ☐ II ☐ III ☐ Project Specific (specify):

1. Relinquished by 28 (Signature/Affiliation)	Date: Time:	1. Received by 28 (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: 29

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions

MCA 3 15 91

stored during shipment from the sample collection site to the analytical laboratory. Shipping containers must be of sufficient number and size to accommodate the samples in an upright condition. Shipping containers must also meet all requirements for the shipment of environmental and/or radioactive samples.

Packaged samples must be shipped to the analytical laboratory in a safe manner that preserves the integrity of the samples. The most common method of sample shipment employs coolers or ice chests that are sealed with custody tape and shipping tape. These coolers must be durable and resistant to crushing during shipment. All coolers must be well maintained and cleaned to prevent cross-contamination of the samples. It is the ultimate responsibility of the person collecting and packaging the sample for shipment to ensure that the shipping containers are clean and functional.

To help prevent sample breakage during shipment, additional consideration must be given to providing shock absorbency to all samples packaged inside the shipping container. Use of bubble-wrap around each sample container is the best way to provide this protection. Foam packing materials and vermiculite are also successfully used.

8.5.2.3 Sample Preservatives

Most analytes have a finite holding time in a given sample matrix. Sample preservation is the chemical or physical means by which samples are treated during and/or following sample collection to aid in the stability of the analytes of interest in that matrix. The preservation of samples at the time of sample collection will follow the requirements of the analytical methods used. This preservation includes the addition of reagents to deter chemical and biochemical degradation and the maintenance of refrigeration during transit and ultimate storage in the laboratory. The required preservatives for the analysis to be performed on each matrix are included in Table 8.5-1 for all inorganic analyses and Table 8.5-2 for all organic analyses. Radiological sample preservatives are listed in Table 8.5-3. USEPA Contract Laboratory Program (CLP) sample preservatives are listed in Table 8.5-4. TCLP sample preservatives are listed in Table 8.5-5.

8.5.2.4 Sample Holding Times

Holding time is defined as the maximum allowable time a sample can be stored after sample collection and preservation (or laboratory receipt for CLP) according to method or client requirements. Each operation has a system in place to ensure that holding times are monitored by each group within the operating unit. It is the responsibility of each Quanterra associate processing the sample to assure that holding times are met. Quanterra laboratories are responsible for meeting all holding times for samples received within 24 hours of collection or if less than half the holding time has passed at the time of sample receipt if the sample is received after 24 hours of collection.

The holding times for inorganic analyses are listed in Table 8.5-1. The holding times for organic analyses are listed in Table 8.5-2. Radiological sample holding times are listed in Table 8.5-3. CLP sample holding times are listed in Table 8.5-4. TCLP sample holding times are listed in Table 8.5-5.

8.5.3 Sample Handling

Each Quanterra laboratory has a SOP describing sample receipt and log-in in detail. The following sections describe the general program followed by all Quanterra operating units.

8.5.3.1 Sample Receipt

Samples shall be received and logged in at Quanterra operations by a designated sample custodian or properly trained associate. Upon sample receipt, the sample custodian shall, as appropriate:

- Wear appropriate personal protective equipment. At a minimum, this consists of gloves, a lab coat, safety glasses, and in some cases a respirator
- Examine the shipping containers to verify that the custody tape is intact
- Examine all sample containers for damage
- Open shipping containers in adequately ventilated areas to assure worker safety
- Determine if the temperature required by the requested testing program has been maintained during shipment. Document the shipping container temperature on the AR/COC
- Initially compare samples received against those listed on the AR/COC
- Verify that sample holding times have not been exceeded
- Examine all sample paperwork for accuracy and completeness
- Determine sample pH (if required for the scheduled analysis) and record on the AR/COC
- Sign and date the AR/COC immediately (only after shipment is accepted) and attach the waybill
- Note any problems associated with the samples on the AR/COC, immediately initiate a Condition Upon Receipt Anomaly Report (see Section 9.1.1), and notify the Project Manager who in turn notifies the client
- Attach appropriate laboratory sample container labels with laboratory identification number and test

- Place the samples in proper laboratory storage.

8.5.3.2 Sample Log-in

Sample log-in activities at Quanterra operating units are fully documented in operation-specific SOPs. The following is a general description of the log-in process:

- Enter the samples in the laboratory sample log-in book, and/or the sample management computer system (QuantIMS) which contains the following information at a minimum:
  - Project identification number
  - Sample numbers (both client and laboratory)
  - Type of samples
  - Required tests
  - Date received at the laboratory
- Notify the Project Manager and appropriate Group Leader(s) of sample arrival
- Place the completed AR/COCs, waybills, and any additional documentation in the project file.

8.5.3.3 Sample Storage

The primary considerations for sample storage are:

- Maintenance at prescribed temperature, if required, which is typically $4° \pm 2°C$
- Processing samples within the prescribed holding time for the parameters of interest
- Maintenance of sample integrity through adequate protection from contamination from outside sources or from cross-contamination of samples. Low-level and high-level samples, when known, must be stored separately. Samples and standards must be stored in separate refrigerators or freezers. Storage areas for volatile organic test requests should be monitored periodically by the analysis of a holding blank (an aliquot of contaminant-free water stored in a VOA vial).

The requirements listed in Tables 8.5-1 through 8.5-5 for temperatures and holding times shall be used. Placing of samples in the proper storage environment is the responsibility of sample control personnel who shall notify the Operations Manager and Group Leaders if there are any samples which must be analyzed immediately because of holding time requirements.

8.5.3.4 Internal Sample Chain-of-Custody and Interlaboratory Transfers

Sample custody within Quanterra laboratories is described in operation-specific SOPs. The sample custody documentation shall include the following minimum requirements:

- Name of associate taking custody of sample from sample storage area for preparation or analysis

- Dates sample removed from and returned to the sample storage area
- Identification of tests to be performed on the sample aliquot(s) selected by the associate
- Sample matrix
- Laboratory sample numbers
- Sample storage location

Additional custody records can be provided by a facility at the specific request of the client. Access to all Quanterra facilities is restricted to prevent any unauthorized contact with samples, extracts or documentation.

Samples transferred to a different laboratory than the original receiving facility are transferred under chain-of-custody (COC). The COC is maintained whether the subcontract laboratory is another Quanterra facility or other subcontract laboratory. If the entire sample volume is transmitted, the original copy of the client's COC will be used to document the relinquishing of the sample and accompany the sample to its destination. A copy of the completed COC form shall be retained in the laboratory project file. In the case where an aliquot of a sample is shipped from the laboratory, a new COC will be generated by the laboratory and shipped with the sample aliquot. The original COC will be retained in the project file at the site holding the original sample container.

Samples are not transferred to other Quanterra facilities or to subcontractor laboratories without prior approval of the client.

8.5.3.5 Sample Disposal and Return Chain of Custody

After the requested analyses on the samples have been completed, any remaining portions of the samples will be maintained by the sample custodian until the samples are disposed of or returned to the client. The disposal of each sample is recorded on the client's COC form or referenced in the project file. Sample disposal procedures and documentation are described in operation-specific SOPs.

For Nuclear Regulatory Commission (NRC) or state licensed laboratories, a real-time inventory of all radioactive isotopes contained in the laboratory (including radioactive samples), as required by the NRC or state is maintained by the Radiation Safety Officer. If the quantities of radioactive materials in-house approach the limits stipulated by the laboratory NRC or state license, appropriate action must be taken to ensure the licensed level is not exceeded.

This may involve returning samples to clients immediately.

If samples are returned to the client rather than disposed of by the laboratory, the original COC is used to document custody transfer back to the client from the laboratory. A copy of the completed COC is retained in the laboratory project file.

8.5.4 Calibration Procedures and Criteria

All equipment and instruments used at Quanterra operations for quantitative measurements are controlled by a formal calibration program. There are two types of calibrations: periodic and operational. These are described in operation-specific SOPs. At a minimum, these procedures shall include:

- Equipment to be calibrated
- Reference standards used for calibration
- Calibration technique
- Acceptable performance tolerances and corrective actions required if specifications are not met
- Frequency of calibration
- Calibration documentation requirements

Whenever possible, recognized procedures such as those published by ASTM or the USEPA or procedures provided by manufacturers shall be adopted. If established procedures are not available, a procedure shall be developed considering the type of equipment, stability characteristics of the equipment, required accuracy, and the effect of operation error on the quantities measured.

8.5.4.1 Physical Reference Standards

Physical reference standards associated with periodic calibrations include weights for calibrating balances and certified thermometers for calibrating working thermometers. Whenever possible, physical reference standards shall have known relationships to nationally recognized standards such as the National Institute of Standards Technology (NIST). If national standards do not exist, the basis for the reference standard shall be documented.

Physical reference standards shall be used only for calibration procedures and shall be stored separately from equipment used for analysis.

8.5.4.2 Chemical Reference Standards

Chemical reference standards are generally associated with operation calibration. These standards include reference materials provided by recognized standards suppliers. This may include vendor-certified materials traceable to NIST or USEPA Standard Reference Materials.

All chemical reference standards maintained in the laboratory for use in calibrations (or as QC spiking solutions) shall be labeled with the following information at a minimum:

- Solution identification including concentration (solutions containing several analytes can be identified such that the solution constituents and concentrations can be referenced in a logbook)
- Solvent
- Preparation date
- Expiration date
- Initials of preparer
- QC Verification confirmation

8.5.4.3 Standard Verification

All standards are verified prior to collection of sample data. Verification procedures can range from a check for chromatographic purity to verification of the concentration of the standard using a standard from an independent source (prepared at a different time, different lot number or obtained from a different source). Certified solutions purchased from vendors may be used as received after review of certification documentation. Failure of the certified solution to meet acceptance criteria requires immediate corrective action, including verification of the solution against a different source or lot number. Standards derived from stock solutions prepared at Quanterra facilities from neat materials must be verified with a solution from an independent source. This verification can occur as part of the calibration procedure only if that procedure includes an independent calibration verification standard as part of the analytical sequence, different from a prepared LCS. All standards which have been successfully verified through any of these procedures are documented on the standard label as passing a QC verification check so that any analyst is aware that the verification procedure has been completed.

Stock and working standards are checked regularly for signs of deterioration, such as discoloration, formation of precipitates, or change in concentration. Care is exercised in the proper storage and handling of standard solutions. Standards are always stored separately from samples.

8.5.4.4 Periodic Calibration

Periodic calibration is performed at prescribed intervals. In general, equipment which can be calibrated periodically is a distinct, singular purpose unit and is relatively stable in performance. These include balances, micropipettors, counters, thermometers, refrigeration, freezers and ovens. Equipment employed at Quanterra operations requiring periodic calibration are listed along with their respective calibration requirements in Table 8.5-6. Each Quanterra operating unit has SOPs in place for the calibration of this equipment if in use at their location.

8.5.4.5 Operational Calibration

Operational calibration is routinely performed as part of instrument usage, such as the development of a standard calibration curve. Detailed requirements for operational calibration are contained in method SOPs. A summary of the various operational calibrations performed at Quanterra operations is shown in Tables 8.5-7 for inorganic method calibrations, Table 8.5-8 for organic method calibrations and Table 8.5-9 for USEPA CLP protocols.

8.5.4.6 Calibration Failure

Equipment that fails calibration or becomes inoperable during use shall be removed from service and segregated to prevent inadvertent use, or shall be tagged to indicate it is out of calibration. Such equipment shall be repaired and successfully recalibrated before reuse.

Recalibration may occur more frequently than scheduled. At any time, if equipment calibration becomes suspect, it shall undergo a calibration check to determine whether the current calibration is still acceptable or if recalibration is required.

8.5.4.7 Calibration Records

Calibration shall be documented for each piece of equipment subject to calibration. All calibration records (periodic and operational) directly affect data and may not be limited to one project. These records shall be stored in the quality and operations files.

8.6 Quality Assessment

The effectiveness of the QA practices at a laboratory is measured by the quality of data generated by the laboratory. Each Quanterra operating unit shall establish, implement and document procedures to detect, prevent, and correct quality problems and to ensure quality improvement. Items and processes that do not meet established requirements must be investigated to determine their cause. Improvements must be implemented in the operations which will prevent a recurrence of these quality problems and provide overall quality performance. All phases of laboratory work should be designed with the objective of preventing problems and improving quality on a continuous basis.

8.6.1 Data Quality Assessment

Data quality is judged in terms of precision, accuracy, representativeness, completeness and comparability. The areas of representativeness, comparability, and completeness for the overall project (inclusive of sampling issues), may be beyond the control of the laboratory. The elements over which the laboratory has direct control are precision, accuracy, and completeness (relative to analytical testing results).

Precision and accuracy assessments are made as part of the evaluation of laboratory QC data generated during sample preparation and analysis. The QC samples employed at Quanterra as part of routine sample analysis are summarized in Section 8.4 of this document. Table 8.6-1 shows the precision and accuracy measurements employed by Quanterra. Analytical method SOPs and QA Policy Number QA-003 include information on all requirements for the type of QC samples, frequencies, and acceptance criteria. Additionally, the SOPs and Policy describe the appropriate actions to be taken when a QC sample result does not meet acceptance criteria.

In-house limits for all QC data must be determined at least annually and compared to those limits published in the methods for applicable matrices. Method limits will be employed until sufficient QC data are acquired. A minimum of 20 to 30 data points is recommended to establish the limits. If in-house limits have a greater standard deviation than published limits (i.e., are not within the bounds of the precision of the published limits) or have an increased negative bias compared to the published limits, the published limits must be used. Investigation and corrective action are required to ensure improvement in method performance and to meet method performance specifications. If in-house limits are within the bounds of published limits, the published limits must be used. Investigation and corrective action are required to ensure improvement in method performance and to meet method performance specifications. If in-house limits are within the bounds of published limits, the calculated limits must be used for assessment of data. Calculated results of these QC samples are evaluated using control tables or control charts. Facility-wide data are accumulated for evaluation and limit determination.

Program specific data analysis requirements for control charts are followed as required for data generated under those programs. These additional requirements shall be documented in QAPjPs or QAPPs. It is the responsibility of each analyst to update any client-required control charts or control tables as a part of routine data reduction.

Table 8.6-1 shows the precision and accuracy measurements employed by Quanterra. Calculated results of these QC samples are evaluated using control tables or control charts. It is the responsibility of each analyst to update any client-required control charts or control tables as a part of routine data reduction. Facility-wide data are accumulated in QuantIMS and are accessed from the database for further evaluation and limit determination.

8.7 Data Reduction, Verification, and Reporting

Data review procedures, defined as a set of computerized and manual checks applied at appropriate levels of the measurement process, will be clearly defined for all measurement systems in SOPs. Data review begins with the reduction (processing) of data and continues through verification of the data and the reporting of analytical results. Calculations are checked from the raw data to the final value prior to reporting results for each group of samples. Data reduction can be performed by the analyst who obtained the data or by another analyst. Data verification starts with the analyst to assure the work is done correctly the first time. Data verification continues with review by a second reviewer who verifies that data reduction has been correctly performed and that the reported analytical results correspond to the data acquired and processed. The procedure is outlined in Figure 8.7-1.

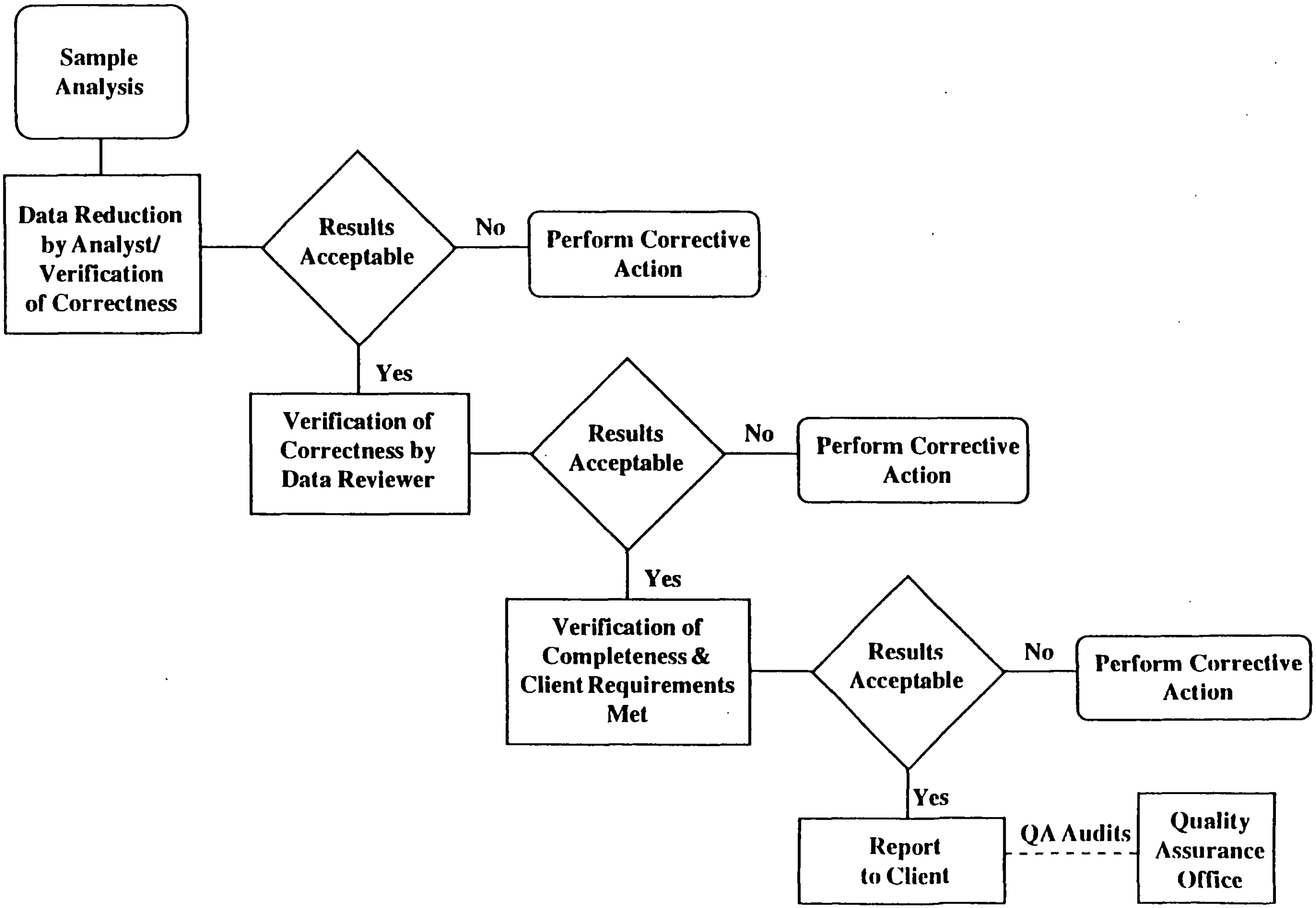
8.7.1 Data Reduction and Initial Verification

Data reduction and initial verification may be performed by more than one analyst depending upon the analytical method employed. The preparation and analytical data may be reviewed independently by different analysts. In these instances, each item may not be applicable to the subset of the data verified or an item may be applicable in both instances. It is the responsibility of the analyst to ensure that the verification of data in his or her area is complete. The data reduction and initial verification process must ensure that:

- Sample preparation information is correct and complete including documentation of standard identification, solvent lot numbers, sample amounts, etc.
- Analysis information is correct and complete including proper identification of analysis output (charts, chromatograms, mass spectra, etc.)
- Analytical results are correct and complete including calculation or verification of instrument calibration, QC results, and qualitative and quantitative sample results

FIGURE 8.7-1

Data Reduction, Verification and Reporting



- The appropriate SOPs have been followed and are identified in the project records
- Proper documentation procedures have been followed
- All nonconformances have been documented and reported
- Internal COC is complete and documented (if applicable)
- Special sample preparation and analytical requirements have been met

In general, data will be processed by an analyst in one of the following ways:

- Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets
- Input of raw data for computer processing
- Direct acquisition and processing of raw data by a computer.

If data are manually processed by an analyst, all steps in the computation shall be provided including equations used and the source of input parameters such as response factors (RFs), dilution factors, and calibration constants. If calculations are not performed directly on the data sheet, they may be attached to the data sheets.

For data that are input by an analyst and processed using a computer, a copy of the input shall be kept and uniquely identified with the project number and other information as needed. The samples analyzed must be clearly identified.

If data are directly acquired from instrumentation and processed, the analyst must verify that the following are correct:

- Project and sample numbers
- Calibration constants and RFs
- Units
- Numerical values used for reporting limits

Analysis-specific calculations for methods are provided in SOPs. In cases where computers perform the calculations, software must be validated or verified, as described in Section 6.0 of this document, before it is used to process data.

The data reduction is documented, signed and dated by the analyst completing the process. Initial verification of the data reduction by the same analyst is documented on a data review checklist, signed and dated by the analyst.

8.7.2 Data Verification

Following the completion of the initial verification by the analyst performing the data reduction, a systematic second-level verification of the data is performed by an experienced peer, technical person, or supervisor. The second level reviewer examines the data signed by the analyst. This review includes an evaluation of all items required in the raw data package. Any exceptions noted by the analyst must be reviewed. Included in this review is an assessment of the acceptability of the data with respect to:

- Adherence of the procedure used to the requested analytical method SOP
- Correctness of numerical input when computer programs are used (checked randomly)
- Numerical correctness of calculations and formulas (checked randomly)
- Correct interpretation of chromatograms, mass spectra, etc.
- Acceptability of QC data
- Documentation that instruments were operating according to method specifications (calibrations, performance checks, etc.)
- Documentation of dilution factors, standard concentrations, etc.

This review also serves as verification that the process the analyst has followed is correct in regard to the following:

- The analytical procedure follows the methods and specific instructions given on the QAS, QAPjP, and project file
- Nonconforming events have been addressed by corrective action as defined on a nonconformance memo
- Relevant comments about sample or analysis problems are clearly stated
- Valid interpretations have been made during the examination of the data and the review comments of the initial reviewer are correct
- The package contains all of the necessary documentation for data review and report production, and results are reported in a manner consistent with the method used for preparation of data reports.

The specific items covered in the second stage of data verification may vary according to the analytical method, but this review of the data must be a documented list with the signature of the person performing the review.

8.7.3 Completeness Verification

A third-level review is performed by the Project Manager. This review is required before results are submitted to clients. This review serves to verify the completeness of the data report and to ensure that client project requirements are met for the analyses performed. The items to be reviewed are:

- Analysis results are present for every sample in the analytical batch or sample delivery group
- Every parameter or target compound requested is reported with either a value or reporting limit
- The correct units and correct number of significant figures are utilized
- If specific data reporting forms were requested, all forms are present and are completed correctly
- All nonconformances and data evaluation statements that impact the data quality are accompanied by clearly expressed comments from the laboratory
- The final report is legible, contains all the supporting documentation required by the project, and is in either the standard Quanterra format or in the client-required format.

A case narrative to accompany the final report will be prepared by project management. This narrative will include relevant comments from the earlier reviews as determined by the Project Manager.

8.7.4 Data Reports

A variety of reporting formats, from computerized data tables, to complex reports discussing regulatory issues, to a CLP-deliverables package, are available. In general, Quanterra reports contain:

- General Discussion: Description of sample types, tests performed, any problems encountered and general comments are given.
- Analytical Data: Data are reported by sample or by test with the appropriate significant figures and reporting limits, adjusted for dilution. Pertinent information including dates sampled, received, prepared, extracted, and analyzed are provided.
- Laboratory Performance QC Information: The results of Laboratory Control Samples analyzed with the project are listed. Also, the analytical results for method blanks generated during analysis of organic, metals, and pertinent wet chemistry parameters are given. Any data or QC anomalies are discussed.
- Matrix-Specific QC Information: Results of any sample duplicates, matrix spikes, or matrix spike duplicates analyzed with the samples as batch QC are reported. Other project-specific QC requested by the client are also reported. The results include supporting information such as amount spiked, percent recovery or percent difference.
- Methodology: Reference for analytical methodology used is cited.
- Other Deliverables: Other deliverables available include disk deliverables, electronic data transfer, sample raw data packages, complete deliverable packages, and custom report formats.

8.7.4.1 Verbal Results

Any analytical results communicated verbally or by facsimile must be reviewed and approved prior to the communication. These results must be of the same quality as the hard copy report.

8.7.4.2 Reporting Analytical Results

Sample results are reported according to analytical method SOPs or contract specification. Normally, the laboratory uses the Quanterra Standard Reporting Limit (SRL) at which any analyte of interest detected at or above that level is reported as a positive value and any analyte of interest not detectable or detected below that level is reported as "not detected" at the SRL.

In some cases a situation may occur, due to a contractual requirement, QAPjP, QAPP, or documented client request, that requires the laboratory to report sample results in a specified manner. Some examples are given below:

- The laboratory may be requested to report all analytes of interest that are less than the laboratory's reporting limit but are measurable by the analysis. This data will be flagged with an appropriate qualifier.
- The laboratory may be requested to report any tentatively identified compounds less than or greater than the laboratory's reporting limit. This data will be flagged with an appropriate qualifier.
- The laboratory may be requested to report sample results using a reporting limit that is higher than their normal level. In this case, only the analytes of interest found at or above that level would be reported as positive values. In this case, the laboratory will state the PSRL rather than the SRL. All analytes of interest not detected or detectable below that level would be reported as "not detected" at the PSRL.

In these types of cases, the laboratory must include documentation in the project file that supports the reporting procedure employed.

It is the responsibility of the laboratory to provide for a reporting system that ensures that any problems associated with an analysis are properly documented on a nonconformance memo, communicated to the appropriate Quanterra associates, and addressed appropriately in the data report.

8.8 Data Validation

Data validation for Quanterra refers to data reviews conducted in accordance with the USEPA CLP "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses" and "Laboratory Data Validation Functional Guidelines for Inorganic Analyses", or modifications thereof, for non-CLP type analyses.

This form of data validation provides an impartial evaluation of the laboratory's results.

It is usually performed by a third party, one which was not involved with the sample analysis. Qualifiers are assigned to data, when required, according to the requirements of the data validation protocol being used. The Quanterra Field Analytical Services (FAS) units routinely provide data validation services.

8.9 Maintenance and Service

Facilities, instruments, equipment, and parts are subject to wear, deterioration, or change in operational characteristics. Within Quanterra, preventive maintenance, coupled with vendor service agreements, is an organized program of actions taken to maintain facilities and equipment.

8.9.1 Analytical Instrumentation and Equipment

The primary purpose of the maintenance program is to prevent instrument and equipment failure and to minimize down time. A properly implemented maintenance program increases the reliability of a measurement system.

Within each laboratory, a Service Coordinator is assigned the responsibility for overseeing the instrument maintenance program. Group Leaders and analysts actually implement and document the maintenance program.

Each instrument or piece of equipment shall be uniquely identified. Each operating unit shall maintain the following:

- Instrument/equipment inventory list
- Instrument/equipment major spare parts list or inventory
- External service agreement documents (if applicable)
- Instrument-specific preventive maintenance logbook or file for each functional unit.

The record of maintenance shall include at a minimum:

- Actions taken, including parts replaced
- Analyst initials and the date maintenance was performed whether by the analyst or a contracted service representative.

Quanterra documents and describes in detail instrument or equipment preventive maintenance in operation-specific SOPs. SOPs are specific to the type of instrument or equipment being used for sample analysis. Preventive maintenance schedules for instruments used at Quanterra laboratories are shown in Tables 8.9-1 through 8.9-26.

8.9.2 Facilities

Another important aspect of the laboratory operation is the existence and maintenance of adequate, safe, and clean facilities including appropriate engineering controls such as proper ventilation, lighting, dust control, hoods, air flow, protection from extreme temperatures, waste disposal, and a source of stable power.

The maintenance and use of these facilities and proper operations are described in the Quanterra Chemical Hygiene Plan (CHP). The Laboratory Director, through a facilities maintenance staff, has responsibility for ensuring properly maintained facilities.

The Laboratory Director also has the responsibility for ensuring that samples are stored properly without contamination, work areas are equipped with adequate bench, hood and operational space, and the areas are free from chemical and radiological contamination that may effect the analytical results.

8.9.3 Frequency of Maintenance

The frequency of maintenance must consider manufacturer's recommendations and previous experience. Schedules of preventive maintenance along with the required frequency are given in Tables 8.9-1 through 8.9-26 for analytical instrumentation and equipment. Frequency of maintenance for the facility systems is documented in the CHP.

8.10 Other Requirements

8.10.1 Water

High purity water (i.e., ASTM reagent grade or equivalent water) will be used in all metals, radiological, wet chemistry, and organic analyses. Proof of contaminant-free water is shown through the use of the waters as method blanks for the analyte of interest. This water is obtained by the use of either a commercial ion-exchange deionizing, distillation, or reverse osmosis unit plus an appropriate polishing unit. The resulting water has a maximum conductivity of 1.0 umho-cm at 25° C or a minimum resistivity of 1.0 Mohm at 25° C. Conductivity and/or resistivity will be documented daily or on each day that water is dispensed for analytical use. Maintenance documentation will be kept for both the deionizing units and the polishing unit.

For volatile analyses the water may be further purified by purging with an inert gas before use to remove traces of organic solvents.

Water monitoring procedures used by Quanterra operating units are detailed in operation-specific SOPs.

8.10.2 Compressed Air and Gases

Ultra high purity compressed gases from preapproved vendors will be used when required for instrumentation. Compressed air and gases must meet the requirements and specifications of the analytical methods performed. In-line filters will be used when appropriate to minimize contamination and moisture from the gases.

8.10.3 Glassware Preparation

Glassware preparation procedures implemented at Quanterra operating units are designed to ensure that contaminants are not introduced during sample analysis. Procedures describing glassware preparation are detailed in operation-specific SOPs.

8.10.4 Chemical Storage

Storage of chemicals shall be conducted in a manner to minimize the potential for fire or release of hazardous material resulting from an unplanned chemical reaction. Refrigerators used for storing flammable liquids must have spark-free interior construction. Flammable solvents shall be stored in appropriate cabinets meeting all necessary codes. All chemicals are stored according to chemical compatibility. Further details regarding chemical storage are provided in the Quanterra CHP.

8.10.5 Waste Disposal

Laboratory wastes shall be disposed of safely and in a manner consistent with applicable regulations. The Laboratory Director, or his designee, is responsible for the development, implementation and maintenance of site specific procedures that will document all aspects of the disposal program. These procedures and the training requirements are described in the Quanterra CHP.

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9.0 Quality Assessment and Response

9.1 Nonconformances and Corrective Action

A nonconformance is an unplanned deviation from an established protocol or plan. The deviation may be the result of Quanterra's actions, then termed a deficiency, or the result of events beyond the control of Quanterra, then termed an anomaly.

Corrective actions are measures taken to rectify conditions adverse to the quality of a product or system and, where possible, to preclude their recurrence. Corrective actions should be timely, determine the root cause and evaluate any propagation of the error or problem. Corrective actions should be implemented with an understanding of the technology and work activities associated with the quality element, with appropriate training of Quanterra associates and vendors, and should be monitored for progress and success.

9.1.1 Condition Upon Receipt Anomaly Report

A Condition Upon Receipt Anomaly Report (CUR) is generated by sample control during the sample log-in process to document anomalies identified upon the receipt of samples in the laboratory. These anomalies are outside of laboratory control and do not require corrective actions to be taken within the laboratory. The affected client shall be notified by the Project Manager or designee of all CURs generated for their samples. The Project Manager is responsible for resolving with the client how to proceed with the samples. CURs must be resolved prior to sample preparation and analysis. The completed CUR form shall be stored the project file. An example CUR is shown in Figure 9.1-1.

9.1.2 Nonconformance Memo

Deficiencies and anomalies for all activities other than sample log-in shall be documented on a nonconformance memo. A log or computerized data base will be maintained for all nonconformances determined to be deficiencies. Deficiencies will be examined for trends quarterly, and this evaluation will be documented and reported to management. The original nonconformance memo will be kept in the project files along with the data it refers to. If a nonconformance does not directly apply to the data, the original form shall be kept in the quality and operations files. An example nonconformance memo is shown in Figure 9.1-2.

9.2 Audits

Audits of Quanterra laboratories are performed to assess the degree of adherence to policies, procedures, and standards. These assessments

FIGURE 9.1-1

Example Quanterra Condition Upon Receipt Anomaly Report (CUR)

Work Order No.:__________

Client:__________ Date:__________

Project No:__________ Initiated by:__________

Analysis Requested:__________ RFA/COC Numbers:__________

Client Sample Numbers Affected:__________

Condition/Anomaly/Variance (Check all that apply):

1 ☐ Not enough sample received for proper analysis.
Received approximately:__________

2 ☐ Sample received broken/leaking.

3 ☐ Sample received without proper preservative.

☐ Cooler temperature not within 4°C ± 2°C
Record temperature:__________

☐ pH__________

☐ other:__________

4 ☐ Sample received in improper container.

5 ☐ Sample received without proper paperwork. Explain:
____

6 ☐ Paperwork received without sample.

7 ☐ No sample ID on sample container.

8 ☐ Custody tape disturbed/broken/missing.

9 ☐ Sample splits performed by lab.

10 ☐ Volatile sample received with approximately
__________ mm headspace.

11 ☐ Sample ID on container does not match sample ID on paperwork. Explain: __________
____
____

12 ☐ All coolers on airbill not received with shipment.

13 ☐ Other (explain below):
____
____
____

Corrective Action:

☐ Client's Name: __________ Informed verbally on: __________ By: __________

☐ Client's Name: __________ Informed in writing on: __________ By: __________

☐ Sample(s) processed "as is". __________

☐ Sample(s) on hold until: __________ If released, notify: __________

Sample Control Supervisor Review:__________ Date: __________

Project Management Review: __________ Date: __________

SIGNED ORIGINAL MUST BE RETAINED IN THE PROJECT FILE

FIGURE 9.1-2
EXAMPLE QUANTERRA LABORATORY NONCONFORMANCE MEMO (NCM) (PAGE 1 OF 2)

Project ID: ______________ Sample Numbers: ______________
NCM Initiated by: ______________
Analyst/Team: ______________
Tests ______________

Analytical Area (check appropriate area):

❑ Sample control	❑ GC	❑ Wet chemistry	❑ Data review
❑ Organic preparation	❑ HPLC	❑ Metals	❑ Radiochemistry
❑ Inorganic preparation	❑ GC/MS	❑ Reporting	❑ ______________

Nonconformance (check appropriate area):

Holding Time Violations (exceeded by ________ days)	***Quality Assurance/Quality Control***
Category I: Laboratory Independent	❑ 17. QC data reported outside of controls
❑ 1. *Holding time expired in transit*	❑ 18. Incorrect procedure used
❑ 2. Sample received > 48 hrs. or 1/2 holding time has expired	❑ 19. SOP intentionally modified with QA and Tech. approval
❑ 3. Test added by client after expiration	❑ 20. Invalid instrument calibration
Category II: Laboratory Dependent	❑ 21. Insufficient sample received for proper analysis
❑ 4. Instrument failure	***Incorrect or Incomplete Client Deliverable***
❑ 5. Analyst error	❑ 22. Hardcopy deliverable error
❑ 6. Login error	❑ 23. Electronic deliverable error
❑ 7. Miscommunication	***Reported detection limits elevated due to:***
❑ 8. Other (complete description required)	❑ 24. Sample matrix
Category III: Analysis Reruns (QA/QC)	❑ 25. Insufficient sample volume
❑ 9. Surrogates	❑ 26. Other (complete description required)
❑ 10. Internal Standards	❑ 27.*Other (specify):* ______________
❑ 11. Spike Recoveries	
❑ 12. Blank Contamination	Comments/Explanation: ______________
Category IV: Analysis Reruns (Confirmation)	
❑ 13. Second column	
❑ 14. Contamination check	
❑ 15. Confirmation of matrix effects	
❑ 16. Other (complete description required)	

Notification (check appropriate area):

Client notified by (name and date): ______________	Client's name and response: ______________
❑ in writing ❑ by facsimile	❑ ❑
❑ by telephone ❑ other (explain)	❑ on hold until ❑

Project Manager (signature and date): ______________

FIGURE 9.1-2

EXAMPLE QUANTERRA LABORATORY NONCONFORMANCE MEMO (NCM) (PAGE 2 OF 2)

Corrective Action

Root Cause Initial and date: ______________________

____

____

____

Corrective Action Initial and Date: ______________________

____

____

____

____

Responsibility for performing CA assigned to: ______________________

Actions to prevent recurrence Initial and Date: ______________________

____

____

____

____

Group Leader/Operations Manager signature: ______________________ Date: ____________

Project Manager signature: ______________________ Date: ____________

Quality Assurance Review

☐ Anomaly ☐ Deficiency

☐ Further action required: ______________________

____

____

Assigned to: ______________________

QA signature: ______________________ Date: ____________

Corrective Action Verification

☐ Verified

☐ Cannot Verify (specify reason): ______________________

____

Nonconformance Memo Closure

QA signature: ______________________

are conducted internally by Quanterra personnel and externally by clients and regulatory agencies. Audits can identify areas for improvement with regard to compliance with policies, procedures, and standards. Audits also provide a means for correction prior to system failure. The following types of audits and assessments are performed at Quanterra laboratories:

- Performance Audits
- Systems Audits
- Data Audits
- Spot Assessments
- Compliance Audits.

Internal audits are generally conducted by QA staff, although periodic self-audits may be conducted by the operational units. Audits and assessments are generally conducted through the use of checklists and appropriate reference documents. Systems and compliance audits are conducted with an opening meeting in which representatives from management, key operational staff, and QA staff participate. The opening meeting provides a review of the objectives of the audit and the schedule required to conduct the audit. At the completion of the audit, a debriefing is held to outline the findings, including identification of positive performance, to discuss requirements in areas of deficiencies, and to answer questions. Spot assessments are generally more informal than systems or compliance audits, and may be conducted without prior scheduling.

The findings of all audits and assessments are documented as is the laboratory response and any corrective actions. Follow-up checks are performed and the status of implementation of corrective actions is documented for all categories of audits and assessments. This cycle continues until all issues are closed.

9.2.1 Performance Audits

Performance audits or performance evaluations are conducted to verify the ability of the laboratory to correctly identify and quantitate compounds in check samples. These samples may be supplied internally or externally as blind or double-blind samples. These samples demonstrate data quality through statistical analysis. The results of internal performance audits may be used to document the training level of the analyst performing the work or to assess the overall performance of the facility. Periodic double-blind performance audits are conducted by Quanterra to assess all aspects of laboratory performance from project initiation through analysis and reporting. Each laboratory QA Manager is responsible for ensuring that performance audit sample(s) are analyzed quarterly (either external or internal).

The results of each performance audit shall be reported to laboratory management. All performance audit results which are identified as unacceptable must be investigated. It is recommended that any results which are flagged as exceeding the warning limits, but within the control limits for the study shall also be reviewed. The findings of the investigation and corrective action taken must be documented. This documentation for all external performance audits shall be provided to the agency or client supplying the audit, as well as being including in the QA monthly report to management.

9.2.2 Systems Audits

A systems audit assesses fulfillment of the QMP and the state of the QMS. Each laboratory undergoes numerous systems audits performed by external parties, including certifying agencies and clients.

9.2.2.1 Internal Systems Audits

An annual systems audit will be performed under the direction of the Corporate Director of Quality Assurance. This audit is performed to assess each laboratory's adherence to the requirements of the QMP and QAMP and to assess the status of corrective actions from other audits at that facility.

The Corporate Director of Quality Assurance shall appoint a lead auditor to conduct the systems audit. A corporate audit checklist shall be used. The lead auditor has the authority to lengthen the audit, revise the scope of the audit, stop work, or specify an accelerated schedule for re-audit. The lead auditor shall be responsible for preparing a report detailing the results of the audit. The report shall be submitted to the audited Laboratory Director and Laboratory QA Manager within four weeks of the audit. Copies of the report shall be distributed to the Regional QA Director, the Regional Operations Vice President, the Senior Vice President of Operations Services, and the President. The audited laboratory must respond in writing within four weeks of receiving the audit report.

The audit report shall have the following sections:

- Introduction
- Purpose
- Scope
- Summary
- Findings
- Comments.

Findings are defined as those noncompliant practices which require corrective action. Comments are considered advice and do not require a corrective action response. It is the responsibility of the QA Manager at each facility to verify implementation of the corrective actions and close all internal audit findings. This process shall be documented and the report shall be provided to the recipients of the original audit report.

Internal audit reports shall be maintained according to the Quanterra Record Retention Policy as confidential documents and shall not be released for use outside the laboratory. External auditors may view internal audit reports as part of their on-site audit.

9.2.2.2 External Systems Audits

Audits of Quanterra laboratories are performed by external agencies and clients. All scheduled audits shall be placed on the facility's calendar with the knowledge of the Laboratory Director and the Laboratory QA Manager to assure no scheduling conflicts occur and that appropriate staff will be available to meet the agencies or client's objectives.

All deficiencies reported to the laboratory must be satisfactorily responded to in a timely manner. Corrective actions taken must also be documented. A copy of the external audit report and the laboratory's response, documenting corrective actions, must be provided to the Laboratory Director, the Regional Director of Quality Assurance, the Corporate Director of Quality Assurance, and the Vice President and General Manager of Laboratory Operations. It is the reponsibility of the QA Manager to verify implementation of the corrective actions and close all findings from the audit.

9.2.3 Data Audits

Data audits will be routinely performed and documented to ensure that project records meet project requirements as described in method SOPs, project plans, or other documented requirements. The data audit is used to identify any lab errors that may have occurred. The laboratory QA Manager is responsible for performing data audits as specified in QA Policy No.: QA-005.

9.2.4 Spot Assessments

Spot assessments are conducted to monitor or observe a process or activity in order to verify conformance to the specified requirements for that activity. These assessments are performed monthly, unless a systems audit or follow-up audit is performed by the QA Manager or Corporate QA office. The scope of the assessment is determined by the QA Manager and may be directed based on information obtained from client inquiries, trends in recorded nonconformances, performance audits, or other sources. A spot assessment may be used to assess a procedure performance relative to the documented SOP. This assessment identifies deviations from requirements that may not be detected in a detailed review of the data package alone. Such an assessment is conducted by observation of the associates performing the task compared with the documented SOP. In some cases, the assessment may be conducted through interviews with the associate when observation of a task is not possible. Review of relevant documentation for the completed procedure is included in such an assessment. A checklist may be used in conducting the assessment. The results of the assessment are documented, as are the corrective actions. All deficiencies noted as a result of a spot assessment must be corrected by the responsible staff in a timely manner.

9.2.5 Compliance Audits

Compliance audits may consist of any combination of the previously described audits. A compliance audit is conducted to ensure that the laboratory is performing according to explicit contract requirements. These requirements may be stated in a contract, QAPjP, Statement of Work, analytical methods, or some combination of these documents. In addition, a compliance audit may include assessment of the administrative requirements of the contract, such as small business subcontracting plans, invoices, and notifications. The technical aspects of the compliance audit are assessed by the QA staff while the administrative aspects are assessed by a representative of the Contract Compliance Officer. Compliance audits are initiated at the request of the Contract Compliance Officer.

9.3 Quality Reports to Management

The QA Manager, Regional Director of Quality Assurance, and Corporate Director of Quality Assurance shall prepare reports to management on a monthly basis indicating the effectiveness of the QMS.

These monthly reports to management shall, at a minimum, include discussion of the following activities:

- Internal audits including systems, data, and spot assessments
- External audits by clients or agencies
- Subcontractor audits
- Status of certifications and approvals
- Performance Evaluation Sample results
- List of QA program or project plans reviewed or signed by the laboratories
- List of SOPs under development, review or issued
- Summary of client inquiries for which QA was asked to assist the laboratory in making a response
- Nonconformance summary.

The regional and corporate reports serve as executive summaries to the member of senior management of the detailed information provided by the QA Managers.

9.4 Management Review of the QMS

The management and supervisory staff at all levels shall assess the QMS. Management assessment shall identify barriers that hinder the organization from achieving its objectives in accordance with quality, safety, and environmental requirements. Results of management assessments shall be documented and acted upon. The effectiveness of the implementation of corrective actions shall be included in the next management assessment.

During the systems audits, the QMS is discussed with the management of the audited facility. This feedback is necessary so that the changing needs of the environmental industry can be met.

Review of the adequacy of the Quanterra QMS is ongoing. At any time, a Regional Vice President and General Manager of Laboratory Operations or a Laboratory or FAS Director may present, in writing, recommended changes to the Corporate Director of Quality Assurance or to the Vice President of Quality and Productivity.

In addition to these reviews, the Senior Vice President of Operations Services shall conduct an annual review of the QMS considering:

- Results of the systems audits to assess trends and effectiveness
- Status of quality documents for adequacy.

The Senior Vice President of Operations Services may consult with the Corporate Director of Quality Assurance, the Vice President of Quality and Productivity, or the Vice Presidents of Laboratory Operations during the review. To document the review, the Senior Vice President of Operations Services will issue a memo to the President and CEO, the Vice President of Quality and Productivity, and the Corporate Director of Quality Assurance stating the extent of the review and recommendations.

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10.0 Quality Improvement

Quality improvement at Quanterra is a critical element of our quality strategy as well as our business strategy. Quanterra will become a World Class organization through a commitment to continuous process improvement. Every Quanterra associate must understand that continuous improvement is a guiding principle pertinent to all aspects of our business.

10.1 Quanterra Teams

Systems within an organization must be established in order for the quality improvement process to succeed. As an example, Quanterra's Partnership in the Workplace is a structured method for ensuring employee involvement that aligns business goals with quality goals at all levels of the organization.

There are three fundamental types of quality-related teams in the Quanterra organizational structure: the Quality Steering Committee, Quality Improvement Teams (QITs) and Corrective Action Teams (CATs). The following sections describe these three fundamental teams.

10.1.1 Quality Steering Committee

The Quality Steering Committee provides the overall Total Quality direction and guidance for Quanterra. This includes allocating resources, scheduling, coordinating education, providing an emphasis on the cost of quality, and defining quality-related terms and concepts. The Quality Steering Committee is responsible for approving Quanterra's Total Quality process.

10.1.2 Quality Improvement Teams

Quality Improvement Teams (QITs) implement and manage the Total Quality efforts within laboratory operations, as well as within functional parts of the organization (e.g., sales, QA, human resources, and IS). QITs must have memberships that reflect every key function in a given operational unit or function. Active participation by key managers on the QIT gives the team the authority to establish priorities for process improvement and to sanction Corrective Action Teams.

10.1.3 Corrective Action Teams

Corrective Action Teams (CATs) investigate problems that have been assigned by the QIT. The CAT shall identify the root cause(s) of the problem and propose solutions. Team members assigned to CATs are the people best equipped through knowledge, expertise, skills, and ownership to solve the problem. The CATs are disbanded once the task has been completed.

10.2 Quality Tools

In order to be fully effective, members of QITs and CATs must receive training. As QITs and CATs are formed, each team member must receive training regarding the selection of quality tools that are available to them as well as orientation on the basics of team building and problem-solving techniques. A variety of quality tools shall be used by Quanterra employees in the pursuit of process improvement and they are listed below.

10.2.1 Impact

Impact is a systematic, team-driven method of problem solving designed to improve processes through time-based process management. The purpose of impact is to reduce cycle time, removing non value-added steps, and reducing sources of error. Impact provides a mechanism to identify, analyze, and redesign processes. Impact requires the implementation of improvement measures to document success.

10.2.2 Solutions

Solutions (Problem Solving Skills) is a method of problem solving, decision making, and opportunity analysis. The method provides tools for appraising a situation, analyzing critical issues and fixing problems permanently.

10.2.3 Benchmarking

Benchmarking is a step-by-step method of improving performance by identifying and studying best practices and comparing them to current practices.

10.2.4 Communications and Group Dynamics

Communications and Group Dynamics is a program designed to increase the effectiveness of individuals when working as part of a team. The program has three seminars: Interpersonal Skills, Group Participation Skills, and Group Management Skills.

10.3 Quality Measures and Standards

Measures and standards used by Quanterra are fundamental to achieving our commitment to continuous improvement. With most business processes, performance is generally measured at the end. Quanterra managers must provide continuous feedback to all associates regarding performance measures and standards.

The following describes two of Quanterra's measures. Additional measures and standards shall be added to track programs, processes, or projects as appropriate.

10.3.1 Key Result Indicators

Key Result Indicators (KRIs) measure performance in areas considered critical to achieving World Class Quality in customer satisfaction and business performance. KRIs focus quality measures on the customer as well as the processes that our customers value. KRIs are intended to demonstrate continuous improvement and focus on the "vital few" issues for the business.

10.3.2 Quality Management Plan Self Assessment

Quality Management Plan Self Assessment is an assessment tool for evaluating the effectiveness and implementation of elements of Quanterra's QMP. The QMP Self Assessment must be conducted on an annual basis in each Quanterra facility. The QMP Self Assessment is based upon Baldridge Standards and includes the review of well-defined categories.

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TABLES

Tables

Quality Assurance Management Plan
Quanterra Incorporated

Table Section

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TABLE 2.3-1
Quanterra Quality Assurance Management Plan Requirements Matrix

EPA QA/R-2	Quanterra QMP (Rev 0) and QAMP (Rev 0)	ANSI/ASQC E4-19xx	QAMS 005/80	NQA-1[1]	5700.6C[2]	ANSI N 13.30	ANSI/ASQC Q91-1987[3]
1 Management and Organization	1.0 Management Commitment and Organization	2.1 Management and Organization	5.04 Project Organization and Responsibility	1 Organization	9.a. General	1.1 Introduction 1.2 Purpose 1.3 Scope	4.1 Management Responsibility
2 Quality System and Description	2.0 Quality System and Description	2.2 Quality System and Description	5.03 Project Description	2 Quality Assurance Program	1 Program	2.1 Special Word Usage 2.2 Specific Terms 5.1 Quality Assurance 5.2 Quality Control	4.2 Quality System
3 Personnel Qualification and Training	3.0 Associate Qualification and Training	2.3 Personnel Training and Qualification	N/A	2 Quality Assurance Program	2 Personnel Training and Qualification	3.2 Personnel Preparation	4.18 Training
4 Procurement of Items and Services	4.0 Procurement of Items and Services	2.4 Procurement of Items and Services	N/A	4 Procurement Document Control 7 Control of Purchased Items and Services	7 Procurement	N/A	4.6 Purchasing
5 Documentation and Records	5.0 Documentation and Records	2.5 Documents and Records	5.01 Title Page 5.02 Table of Contents	6 Document Control 17 Quality Assurance Records	4 Documents and Records	3.6 Direct Bioassay-Record Retention 4.5 Indirect Bioassay-Record Retention	4.5 Document Control 4.16 Quality Records

TABLE 2.3-1
Quanterra Quality Assurance Management Plan Requirements Matrix
(Continued)

EPA QA/R-2	Quanterra QMP (Rev 0) and QAMP (Rev 0)	ANSI/ASQC E4-19xx	QAMS 005/80	NQA-1[1]	5700.6C[2]	ANSI N 13.30	ANSI/ASQC Q91-1987[3]
6 Computer Hardware and Software	6.0 Use of Computer Hardware and Software	2.6 Computer Hardware and Software	N/A	3 Design Control	N/A	N/A	ISO 9000-3[4]
				11 Test Control			
7 Planning	7.0 Planning	2.7 Planning	5.05 QA Objectives for Measurement Data	2 Quality Assurance Program	1 Program	3.1 Facility Criteria	4.8 Product Identification and Traceability
		3.1 Planning and Scoping	5.06 Sampling Procedures	3 Design Control	6 Design	3.4 Direct Bioassay-Performance Criteria for Service Laboratories	4.11 Inspection, Measuring, and Test Equipment
		3.3 Implementation of Planned Operations	5.07 Sample Custody	5 Instructions, Procedures, and Drawings	N/A	3.5 Direct Bioassay-Reporting Results	
			5.08 Calibration Procedures and Frequency	8 Identification and Control of Items		4.1 Indirect Bioassay-Responsibilities of the Service Laboratory Customer	
			5.09 Analytical Procedures	9 Control of Processes		4.2 Indirect Bioassay-Analytical Methodology	
			5.11 Internal Quality Control Checks	11 Test Control		4.3 Indirect Bioassay-Performance Criteria for Service Laboratories	
			5.13 Preventive Maintenance	13 Handling, Storage, and Shipping		5.2 Quality Control	

TABLE 2.3-1
Quanterra Quality Assurance Management Plan Requirements Matrix
(Continued)

EPA QA/R-2	Quanterra QMP (Rev 0) and QAMP (Rev 0)	ANSI/ASQC E4-19xx	QAMS 005/80	NQA-1[1]	5700.6C[2]	ANSI N 13.30	ANSI/ASQC Q91-1987[3]
8 Implementation of Work Processes	8.0 Work Processes and Operations	2.8 Implementation of Work Processes	N/A	1 Organization	5 Work Processes	3.1 Facility Criteria	4.9 Process Control
				5 Instructions, Procedures, and Drawings	6 Design		
		3.2 Design of Data Collection Operations		10 Inspection 12 Control of Measuring and Test Equipment 14 Inspection, Test, and Operating Status	8 Inspection and Acceptance Testing		
9 Assessment and Response[5]	9.0 Quality Assessment and Response	2.9 Assessment and Response	5.10 Data Reduction, Validation, and Reporting	2 Quality Assurance Program	9 Management Assessment	3.3 Direct Bioassay-Interpretation of Measurements	4.10 Inspection and Testing
		3.4 Assessment and Response	5.12 Performance and System Audits	13 Handling, Storage, and Shipping		3.5 Direct Bioassay-Reporting Results	4.13 Control of Nonconforming Products
		3.5 Assessment and Verification of Data Usability	5.14 Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness	15 Control of Non-conforming Items	10 Independent Assessment	4.4 Indirect Bioassay-Reporting Results	4.14 Corrective Action
			5.15 Corrective Action	16 Corrective Action		6.1 Direct Bioassay Measurements	4.17 Internal Quality Audits

TABLE 2.3-1
Quanterra Quality Assurance Management Plan Requirements Matrix
(Continued)

EPA QA/R-2	Quanterra QMP (Rev 0) and QAMP (Rev 0)	ANSI/ASQC E4-19xx	QAMS 005/80	NQA-1[1]	5700.6C[2]	ANSI N 13.30	ANSI/ASQC Q91-1987[3]
9 Assessment and Response[5] (Continued)			5.16 Quality Assurance Reports to Management	18 Audits		6.2 Indirect Bioassay Measurements	4.20 Statistical Techniques
9 Quality Improvement[5]	10.0 Quality Improvement	2.10 Quality Improvement	N/A	N/A	3 Quality Improvement	N/A	N/A

Footnotes

(1) Section II, "Basic Requirements."
(2) Criterion from Section 9, "Requirements."
(3) Technically equivalent to ISO 9001.
(4) Quality Management and Quality Assurance Standards, ISO 9000, Part 3, "Guidelines for the Application of ISO 9001 to the Development, Supply and Maintenance of Software."
(5) This document has two sections numbered "9."

TABLE 4.2-1
List of Quanterra Quality-Related Items that Require Evaluation Prior to Use

Quality-Related Item	Standard Operating Procedure for Quality Testing
Acetone	CORP-QA-0001
Dichloromethane	CORP-QA-0001
Hexane	CORP-QA-0001
Hydrochloric acid	CORP-QA-0001
Freon	CORP-QA-0001
Methanol	CORP-QA-0001
Nitric acid	CORP-QA-0001
Sulfuric acid	CORP-QA-0001
Toluene	CORP-QA-0001

TABLE 5.1-1
Quanterra Quality Documents and Required Approval

Document	Required Approval
Quality Management Plan (QMP)	• Corporate Director of Quality Assurance • Vice President of Quality and Productivity • Senior Vice President of Operations Services • President and Chief Executive Officer (CEO)
Quality Assurance Management Plan (QAMP)	• Regional Director(s) of Quality Assurance • Corporate Director of Quality Assurance • Senior Vice President of Operations Services • Vice President and General Manager of Laboratory Operations
Quality Assurance Management Plan (QAMP) Facility Appendix	• Quality Assurance Manager • Laboratory Director • Regional Director of Quality Assurance
Corporate Standard Operating Procedures (SOP)	• Corporate Director of Quality Assurance • Corporate Director of Environmental Health and Safety[1] • Management (generally a Vice President/General Manager of Laboratory Operations)
Operation-Specific Standard Operating Procedures (SOP)	• Quality Assurance Manager • Laboratory Health and Safety Coordinator[1] • Laboratory Director
Quality Policy Documents	• Corporate Director of Quality Assurance • Senior Vice President of Operations Services

Footnotes

(1) Required only if procedure encompasses more than standard office safety requirements.

TABLE 5.2-1
Quanterra Quality Document Review Requirements

Document Type	Frequency of Review	Responsible Party
Quality Management Plan (QMP)	Annual	Corporate Director of Quality Assurance Vice President of Quality and Productivity
Quality Assurance Management Plan (QAMP)	Annual	Corporate Director of Quality Assurance Regional Directors of Quality Assurance
Quality Assurance Management Plan (QAMP) Facility Appendix	Quarterly	Quality Assurance Manager
Corporate Standard Operating Procedures (SOP)	Annual	Corporate QA Staff
Operation-Specific Standard Operating Procedures (SOP)	Annual	Laboratory Staff
Quality Policy Documents	Annual	Corporate Director of Quality Assurance

TABLE 7.3-1

Activities Performed by the Customer Service Team

Activity	Lead Responsibility
Respond to information requests	Customer Service Manager
Client presentations	Accounts Manager
Client partnering and teaming arrangements	Accounts Manager
Regulatory, technical, and business review of solicitations	Customer Service Manager/Project Manager
Proposal preparation	Accounts Manager/Customer Service Manager
Contracts review and implementation	Contracts
Capacity needs definition and networking requirements	Customer Service Manager
Definition of project-specific client satisfaction criteria and indicators	Customer Service Manager
QA plan preparation, review, and presentation	Project Manager
Subcontractor lab audits	Quality Assurance Manager
Readiness reviews	Project Manager
Kick off meetings	Customer Service Manager/Project Manager
Periodic summary reports of performance	Project Manager
Electronic deliverables specification and capabilities development	Customer Service Manager/Information Systems
Project specific methods modification and definition	Project Manager
On-going project management and improvement	Project Manager
Client opinion and feedback.	Customer Service Manager

TABLE 8.4-1
Field Quality Control Samples

Type	Applicability		Accuracy and Precision Application	Introduced By
	Inorganic	Organic		
Trip Blank (volatiles)	No	Yes	Accuracy	Supplier of Containers
Field Blank	Yes	Yes	Accuracy	Field Sampler
Rinsate Blank	Yes	Yes	Accuracy	Field Sampler
Collocated Sample	Yes	Yes	Precision	Field Sampler
Split Sample	Yes	Yes	Precision	Field Sampler
Field Duplicate	Yes	Yes	Precision	Field Sampler
Field Matrix Spike	Yes	Yes	Accuracy	Field Sampler

TABLE 8.4-2
Laboratory Quality Control Samples

Type	Frequency	Applicability		Accuracy and Precision Application	Introduced By
		Inorganic/ Radiochemical	Organic		
Analytical Spike	As specified in methods, or as needed	Yes	No	Accuracy	Analyst/ Prep
Duplicate	1 out of 20 or at least 1/month/run	Yes	Yes	Precision	Analyst/ Prep
Internal Standard	Each sample and standard	Yes	Yes	Both	Analyst/ Prep
Laboratory Control Sample	1 per each group of samples processed up to 20 samples.	Yes	Yes	Accuracy	Analyst/ Prep
Matrix Spike	1 per each group of samples processed up to 20 samples.	Yes	Yes	Accuracy	Analyst/ Prep
Matrix Spike Duplicate	1 per each group of samples processed up to 20 samples.	Yes	Yes	Both	Analyst/ Prep
Method Blank	1 per each group of samples processed up to 20 samples.	Yes	Yes	Accuracy	Analyst/ Prep
Surrogate	All standards, method blanks, LCS, and samples.	No	Yes Method Dependent	Accuracy	Analyst/ Prep
Yield Monitor	Operation-specific	Yes	No	Accuracy	Prep

TABLE 8.4-3
Laboratory Performance Quality Control Samples

Sample/Measurement	Purpose
Method Blanks	Demonstrates that the laboratory systems (*e.g.*, glassware cleaning procedures) and laboratory reagents used for the preparation and analysis of samples have not contributed to a false positive or negative measurement.
Instrument Blank	Demonstrates that the analytical system has not contributed to a false positive or negative measurement.
Laboratory Control Sample	Demonstrates the laboratory's ability to perform an analysis within the performance requirements of the method.

TABLE 8.4-4
Matrix Specific Quality Control Samples

Quality Control Sample	Purpose
Duplicate Samples	Estimates the ability of the laboratory to obtain precise measurements on a sample. This measure is dependent on the homogeneity of the sample being duplicated. Solid samples often portray poor sample homogeneity and therefore often have poor duplication with regards to the sample result.
Matrix Spike Sample	Estimates the ability of the laboratory to obtain accurate measurements on a sample. The measure is dependent on the bias a sample matrix may cause regarding a given analyte.
Matrix Spike Duplicate Sample	In addition to verifying the accuracy of the matrix spike sample, the matrix spike duplicate can be used with the matrix spike sample as a measure of precision by calculating the relative percent difference (RPD).

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Acidity	Method Blank	305.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	305.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	305.1	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	305.1	Not Applicable	—	Not Applicable
	Duplicate	305.1	Frequency: 1 per batch of 10 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Alkalinity	Method Blank	310.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	310.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	310.1	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	310.1	Not Applicable	—	Not Applicable
	Duplicate	310.1	Frequency: 1 per batch of 10 samples Criteria: $\leq$ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Ammonia	Method Blank	350.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	350.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Must be within ±10% Corrective Action: If not within control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	350.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	350.1	Not Applicable	—	Not Applicable
	Duplicate	350.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Ammonia (TKN)	Method Blank	351.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	351.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within ±10%. Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	351.2	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	351.2	Not Applicable	—	Not Applicable
	Duplicate	351.2	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
BOD	Method Blank	405.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	405.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	405.1	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	405.1	Not Applicable	—	Not Applicable
	Duplicate	405.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Bromide	Method Blank	320.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	320.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within ±10% Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	320.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	320.1	Not Applicable	—	Not Applicable
	Duplicate	320.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Chemical Oxygen Demand (COD)	Method Blank	410.4	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	410.4	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within ±10% Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	410.4	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	410.4	Not Applicable	—	Not Applicable
	Duplicate	410.4	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Chloride	Method Blank	325.2 325.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9251 9252	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	325.2 325.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery be within ± 10% Corrective Action: If not within laboratory control limits, rerun all associated samples	9251 9252	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples
	Matrix Spike	325.2 325.3	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	9251 9252	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Chloride (continued)	Matrix Spike Duplicate	325.2 325.3	Not Applicable	9251 9252	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.
	Duplicate	325.2 325.3	Not Applicable	9251 9252	Not Applicable
Chlorine, Residual	Method Blank	330.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	330.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Chlorine, Residual (continued)	Matrix Spike	330.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	330.3	Not Applicable	—	Not Applicable
	Duplicate	330.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Water
Chromium (CR VI)	Method Blank	—	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	7196A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES(1)	Method	RCRA(SW846) (2)
Chromium (CR VI) (continued)	Laboratory Control Sample	—	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	7196A	Frequency: 1 with each batch of samples processed not to exceed 20 samples prepped Criteria: percent recovery of analyte must be within ± 15 % Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	—	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit	7196A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Advisory limits are 75% - 125% recovery Corrective Action: Reanalyze if sample remaining. If not, flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	—	Not Applicable	7196A	Not Applicable
	Duplicate	—	Not Applicable	7196A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD(3) limit Corrective Action: Reanalyze if sample remaining. If not, flag data outside of limit.

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Color	Method Blank	110.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	110.2	Not Applicable	—	Not Applicable
	Matrix Spike	110.2	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	110.2	Not Applicable	—	Not Applicable
	Duplicate	110.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: $\leq$ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Not Applicable
Conductivity	Method Blank	120.1	Not Applicable	9050	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Conductivity (continued)	Laboratory Control Sample	120.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9050	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples
	Matrix Spike	120.1	Not Applicable	9050	Not Applicable
	Matrix Spike Duplicate	120.1	Not Applicable	9050	Not Applicable
	Duplicate	120.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: $\leq$ 20 % RPD[3] Corrective Action: Flag data outside of limit.	9050	Frequency: 1 with each batch of samples processed not to exceed 10 samples
Cyanide (Amenable)	Method Blank	335.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9012	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Cyanide (Amenable) (continued)	Laboratory Control Sample	335.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9012	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be within ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	335.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	9012	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Advisory limits are 75% - 125% recovery Corrective Action: Reanalyze if sample remaining. If not, flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	335.1	Not Applicable	9012	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Advisory limits are 75% - 125% recovery Corrective Action: Reanalyze if sample remaining. If not, flag data associated with unacceptable Matrix Spike
	Duplicate	335.1	Not Applicable	9012	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Cyanide (Total)	Method Blank	335.2 335.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9012	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	335.2 335.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9012	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: % recovery must be within ± 20% Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	335.2 335.3	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	9012	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Advisory limit is 75% - 125% recovery Corrective Action: Flag data associated with unacceptable Matrix Spike

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES(1)	Method	RCRA(SW846) (2)
Cyanide (Total) (continued)	Matrix Spike Duplicate	335.2 335.3	Not Applicable	9012	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limit is 75% - 125% recovery Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	335.2 335.3	Not Applicable	9012	Not Applicable
Flashpoint	Method Blank	—	Not Applicable	1010 1020A	Not Applicable
	Laboratory Control Sample	—	Not Applicable	1010 1020A	Not Applicable
	Matrix Spike	—	Not Applicable	1010 1020A	Not Applicable
	Matrix Spike Duplicate	—	Not Applicable	1010 1020A	Not Applicable
	Duplicate	—	Not Applicable	1010 1020A	Frequency: 1 per batch of ≤20 samples Criteria: RPD(3) must be ≤ 20% Corrective Action: Flag data associated with unacceptable Duplicate

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Fluoride	Method Blank	340.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	340.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	340.2	Frequency: 1 per 10 samples by IC Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	340.2	Not Applicable	—	Not Applicable
	Duplicate	340.2	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Hardness	Method Blank	130.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	130.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	130.2	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	130.2	Not Applicable	—	Not Applicable
	Duplicate	130.2	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Iodide	Method Blank	345.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	345.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	345.1	Frequency: 1 per batch of 10 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	345.1	Not Applicable	—	Not Applicable
	Duplicate	345.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Methylene Blue Active Substances (MBAS)	Method Blank	425.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	425.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	425.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	425.1	Not Applicable	—	Not Applicable
	Duplicate	425.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Nitrogen, Nitrate-Nitrite	Method Blank	353.1 353.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	*Nitrate only* Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	353.1 353.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples
	Matrix Spike	353.1 353.3	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	—	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Nitrogen, Nitrate-Nitrite (continued)	Matrix Spike Duplicate	353.1 353.3	Not Applicable	—	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery and RPD must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples
	Duplicate	353.1 353.3	Not Applicable	—	Not Applicable
Odor	Method Blank	140.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	140.1	Not Applicable	—	Not Applicable
	Matrix Spike	140.1	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	140.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Odor (continued)	Duplicate	140.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Not Applicable
Oil and Grease, Petroleum Hydro-carbons	Method Blank	418.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9071	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	418.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9071	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be within ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	418.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit	9071	Frequency: 1 with each batch of samples processed not to exceed 10 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Oil and Grease Petroleum Hydro-carbons (continued)	Matrix Spike Duplicate	418.1	Not Applicable	9071	Not Applicable
	Duplicate (Requires that two samples be sent by client)	418.1	Not Applicable	9071	Frequency: 1 with each batch of samples processed not to exceed 20 sample Criteria: Advisory limits are ≤ 20% RPD[3] Corrective Action: Flag data associated with unacceptable Duplicate
pH	Method Blank	150.1	Not Applicable	9040	Not Applicable
	Laboratory Control Sample	150.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Sample provided by external source, must be within ± 0.05 pH units Corrective Action: If not within laboratory control limits, rerun all associated samples	9040	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Sample provided by external source, must be within ± 0.05 pH units Corrective Action: If not within laboratory control limits, rerun all associated samples
	Matrix Spike	150.1	Not Applicable	9040	Not Applicable
	Matrix Spike Duplicate	150.1	Not Applicable	9040	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
pH (continued)	Duplicate	150.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] limit Corrective Action: Flag data outside of limit.	9040	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Advisory limits are ≤ 20% RPD[3] Corrective Action: Flag data associated with unacceptable Duplicate
Phenol	Method Blank	420.2 420.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9066	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	420.2 420.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9066	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be within ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Phenol (continued)	Matrix Spike	420.2 420.1	Frequency: 1 with each batch of samples processed not to exceed 10 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data associated with unacceptable Matrix Spike	9066	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: 75% - 125% recovery Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	420.2 420.1	Not Applicable	9066	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: 75% - 125% recovery Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	420.2 420.1	Not Applicable	9066	Not Applicable
Phosphorus (Total and Ortho-phosphate)	Method Blank	365.2 365.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Phosphorus (Total and Ortho-phosphate) (continued)	Laboratory Control Sample	365.2 365.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	365.2 365.3	Frequency: 1 per 10 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	365.2 365.3	Not Applicable	—	Not Applicable
	Duplicate	365.2 365.3	Not Applicable	—	Not Applicable
Silica	Method Blank	370.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Silica (continued)	Laboratory Control Sample	370.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	370.1	Frequency: 1 with each batch of samples processed not to exceed 10 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike Duplicate	370.1	Not Applicable	—	Not Applicable
	Duplicate	370.1	Not Applicable	—	Not Applicable
Solids	Method Blank	160.1 160.2 160.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES(1)	Method	RCRA(SW846) (2)
Solids (continued)	Laboratory Control Sample	160.1 160.2 160.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	160.1 160.2 160.3	Not Applicable	—	Not Applicable
	Matrix Spike Duplicate	160.1 160.2 160.3	Not Applicable	—	Not Applicable
	Duplicate	160.1 160.2 160.3	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit	—	Not Applicable
Sulfate	Method Blank	375.4	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9038	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Sulfate (continued)	Laboratory Control Sample	375.4	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9038	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Recovery must be within ± 15 % Corrective Action: Rerun all samples associated with unacceptable LCS (ICV)
	Matrix Spike	375.4	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data associated with unacceptable Matrix Spike	9038	Frequency: 1 with each batch of samples processed not to exceed 10 samples Criteria: Limits are 75% - 125% recovery Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	375.4	Not Applicable	9038	Not Applicable
	Duplicate	375.4	Not Applicable	9038	Not Applicable
Sulfide	Method Blank	376.1 376.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9030A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Sulfide (continued)	Laboratory Control Sample	376.1 376.2	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9030A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Matrix Spike	376.1 376.2	Frequency: 1 with each batch of samples processed not to exceed 10 samples Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	9030A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data associated with unacceptable
	Matrix Spike Duplicate	376.1 376.2	Not Applicable	9030A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: Flag data associated with unacceptable
	Duplicate	376.1 376.2	Not Applicable	9030A	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Sulfite	Method Blank	377.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable
	Laboratory Control Sample	377.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	377.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	—	Not Applicable
	Matrix Spike Duplicate	377.1	Not Applicable	—	Not Applicable
	Duplicate	377.1	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES(1)	Method	RCRA(SW846) (2)
Total Organic Carbon (TOC)	Method Blank	415.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9060	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	415.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	9060	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery must be within ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	415.1	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Flag data outside of limit	9060	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limits are 75% - 125% recovery Corrective Action: Reanalyze if sample remaining. If not, flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	415.1	Not Applicable	9060	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples (Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Total Organic Carbon (TOC) (continued)	Duplicate	415.1	Not Applicable	9060	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: ≤ 20 % RPD[3] limit Corrective Action: Reanalyze if sample remaining. If not, flag data outside of limit.
Total Organic Halides (TOX)	Method Blank	SM 5320	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	9020B	Frequency: 2 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	SM 5320	Frequency: 11 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be within ± 20% Corrective Action: Rerun all samples associated with unacceptable LCS (ICV)	9020B	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be within ± 20% Corrective Action: Rerun all samples associated with unacceptable LCS (ICV)

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Total Organic Halides (TOX) (continued)	Matrix Spike	SM 5320	Frequency: 1 per 10 samples, minimum of one per batch of samples processed Criteria: Must be within ±10% Corrective Action: Reanalyze if sample remaining. If not, flag data with unacceptable Matrix Spike	9020B	Frequency: 1 per batch of 10 samples Criteria: Must be within ±10% Corrective Action: Reanalyze if sample remaining. If not, flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	SM 5320	Not Applicable	9020B	Not Applicable
	Duplicate	SM 5320	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] limit Corrective Action: Reanalyze if sample remaining. If not, flag data outside of limit.	9020B	Frequency: All samples will be analyzed in duplicate Criteria: ≤ 20 % RPD[3] limit Corrective Action: Reanalyze if sample remaining. If not, flag data outside of limit.
Turbidity	Method Blank	180.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration must be less than the reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples (Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Turbidity (continued)	Laboratory Control Sample	180.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Percent recovery must be within laboratory control limits Corrective Action: If not within laboratory control limits, rerun all associated samples	—	Not Applicable
	Matrix Spike	180.1	Not applicable	—	Not Applicable
	Matrix Spike Duplicate	180.1	Not Applicable	—	Not Applicable
	Duplicate	180.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Must be within laboratory QC limits Corrective Action: Flag data outside of limit Not Applicable.	—	Not Applicable
Water Content	Method Blank	—	Not Applicable	—	Not Applicable
	Laboratory Control Sample	—	Not Applicable	—	Not Applicable
	Matrix Spike	—	Not Applicable	—	Not Applicable

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Water Content (continued)	Matrix Spike Duplicate	—	Not Applicable	—	Not Applicable
	Duplicate	—	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] Corrective Action: Flag data outside of limit.	—	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: ≤ 20 % RPD[3] limit Corrective Action: Reanalyze if sample remaining. If not, flag data outside of limit.
GFAA and Flame AA Metals, Mercury by CVAA	Method Blank	200 series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	7000 series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	200 series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be within ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS	7000 series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be within ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
GFAA and Flame AA Metals, Mercury by CVAA (continued)	Matrix Spike	200 series	Frequency: with each batch of samples processed not to exceed 20 samples Criteria: Recovery must be within 80-120 % Corrective Action: Flag data associated with unacceptable MS. (See SOP for detailed corrective action procedure and for other QC procedures.)	7000 series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Recovery must be within 80-120 % Corrective Action: Flag data associated with unacceptable MS. (See SOP for detailed corrective action procedure and for other QC procedures.)
	Matrix Spike Duplicate	200 series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Recovery must be within 80-120 %, RPD must be within 20 % Corrective Action: Flag data associated with unacceptable MSD	7000 series	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Recovery must be within 80-120 %, RPD must be within 20 % Corrective Action: Flag data associated with unacceptable MSD
	Duplicate	200 series	Not Applicable	7000 series	Not Applicable
	Post Digestion Spikes	200 series	Post Digestion Spike is conducted on all samples	7000 series	Post Digestion Spike is conducted on all samples
ICP Metals	Method Blank	200.7	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	6010A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
ICP Metals (continued)	Laboratory Control Sample	200.7	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS	6010A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery of analyte must be ± 20 % Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	200.7	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limits for percent recovery are 80-120% Corrective Action: Flag data associated with unacceptable Matrix Spike	6010A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limits for percent recovery are 80-120% Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	200.7	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limits for percent recovery are 80-120%, RPD must be within 20 % Corrective Action: Flag data associated with unacceptable Matrix Spike	6010A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Limits for percent recovery are 80-120%, RPD must be within 20 % Corrective Action: Flag data associated with unacceptable Matrix Spike

TABLE 8.4-5
Inorganic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
ICP Metals (continued)	Duplicate	200.7	Not Applicable	6010A	Not Applicable
	Serial Dilutions	200.7	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: 10 % Difference Corrective Action: Flag data associated with unacceptable Serial Dilution	6010A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: 10 % Difference Corrective Action: Flag data associated with unacceptable Serial Dilution

Footnotes

(1) National Pollutant Discharge Elimination System

(2) Resource Conservation and Recovery Act (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods), third edition, Final Update I, July 1993.

(3) RPD-Relative Percent Difference

TABLE 8.4-6
Organic Laboratory Quality Control Samples

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Aromatic Volatiles by GC	Method Blank	602	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8020A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	602	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8020A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte must be within historical acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	602	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8020A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Aromatic Volatiles by GC (continued)	Matrix Spike Duplicate	602	Not Applicable	8020A	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	602	Not Applicable	8020A	Not Applicable
	Surrogates	602	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria	8020A	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria
	Internal Standards	602	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate.	8020A	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate.

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Dioxins/ Dibenzo-furans	Method Blank	613	Frequency: 1 per batch of ≤ 20 samples extracted Criteria: Concentration less than reporting limit Corrective Action: Rerun all positive samples associated with unacceptable blank	8280 8290	Frequency: 1 per batch of ≤ 20 samples extracted Criteria: Concentration less than reporting limit Corrective Action: Rerun all positive samples associated with unacceptable blank
	Laboratory Control Sample	613	Frequency: 1 per batch of ≤ 20 samples extracted Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8280 8290	Frequency: 1 per batch of ≤ 20 samples extracted Criteria: percent recovery for each analyte must be within historical acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	613	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8280 8290	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	613	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable matrix spike Duplicate	8280 8290	Frequency: 1 per analytical batch of ≤ 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable matrix spike duplicate

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Dioxins/ Dibenzo-furans (continued)	Duplicate	613	Not Applicable	8280 8290	Not Applicable
	Surrogates	613	Not Applicable	8280 8290	Not Applicable
	Internal Standards	613	Internal standards are added to all samples (QC samples included). Internal standard recovery should be between 40 % to 120 %.	8280 8290	Internal standards are added to all samples (QC samples included). Internal standard recovery should be between 40 % - 120 % for Method 8280 and between 40 % - 135 % for Method 8290. Use limits in laboratory SOP.
Herbicides	Method Blank	615	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit	8150B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	615	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8150B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within historical acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Herbicides (continued)	Matrix Spike	615	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8150B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	615	Not Applicable	8150B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within control limits Corrective Action: Flag data associated with unacceptable matrix spike sample
	Duplicate	615	Not Applicable	8150B	Not Applicable
	Surrogates	615	Not Applicable	8150B	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must fall within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria
	Internal Standards	615	Not Applicable	8150B	Optional

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Nitro-aromatics by HPLC	Method Blank	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within historical acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Nitro-aromatics by HPLC (continued)	Matrix Spike Duplicate	--	Not Applicable	8330	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	--	Not Applicable	8330	Not Applicable
	Surrogates	--	Not Applicable	8330	Not Applicable
	Internal Standards	--	Not Applicable	8330	Not Applicable
PAHs by GC and HPLC	Method Blank	610	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8100 8310	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	610	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8100 8310	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within historical acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
PAHs by HPLC (continued)	Matrix Spike	610	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8100 8310	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	610	Not Applicable	8100 8310	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	610	Not Applicable	8100 8310	Not Applicable
	Surrogates	610	Not specified in method	8100 8310	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: Results must fall within laboratory established control limits Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria
	Internal Standards	610	Optional	8100 8310	Optional

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Pesticides/ PCBs	Method Blank	608	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8080A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	608	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8080A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within historical acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	608	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8080A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES(1)	Method	RCRA(SW846) (2)
Pesticides/ PCBs (continued)	Matrix Spike Duplicate	608	Not Applicable	8080A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	608	Not Applicable	8080A	Not Applicable
	Surrogates	608	Not specified in method	8080A	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: Results must fall within laboratory established control limits Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria
	Internal Standards	608	Optional	8080A	Optional
Petroleum Hydro-carbons (Total) by IR	Method Blank	418.1	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	--	Not Applicable

TABLE 8.4-6
Organic Laboratory Quality Control Samples (Continued)

Analysis	QC Sample	Method	NPDES(1)	Method	RCRA(SW846) (2)
Petroleum Hydro-carbons (Total) by IR (continued)	Laboratory Control Sample	418.1	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within laboratory established acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS	--	Not Applicable
	Matrix Spike	418.1	Frequency: 1 MS per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery must be within laboratory established acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike	--	Not Applicable
	Matrix Spike Duplicate	418.1	Not Applicable	--	Not Applicable
	Duplicate	418.1	Not Applicable	--	Not Applicable
	Surrogates	418.1	Not Applicable	--	Not Applicable
	Internal Standards	418.1	Not Applicable	--	Not Applicable
Purgeable Halocarbons by GC	Method Blank	601	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8010B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Purgeable Halocarbons by GC (continued)	Laboratory Control Sample	601	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8010B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within historical acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	601	Frequency: 1 per 10 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8010B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	601	Not Applicable	8010B	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	601	Not Applicable	8010B	Not Applicable

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Purgeable Halocarbons by GC (continued)	Surrogates	601	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria	8010B	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria
	Internal Standards	601	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate.	8010B	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate.
Semivolatiles	Method Blank	625	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank	8270A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Semivolatiles (continued)	Laboratory Control Sample	625	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery must be within acceptance limits given in method for each analyte Corrective Action: Rerun all samples associated with unacceptable LCS	8270A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte must be within historical acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	625	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8270A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	625	Not Applicable	8270A	Frequency: 1 with each extraction batch of samples not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	625	Not Applicable	8270A	Not Applicable

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Semivolatiles (continued)	Surrogates	625	Surrogates spiked into method blank and all samples (QC included) <u>Method Blank and LCS Criteria</u>: All surrogates must be in control before sample analysis may proceed. <u>Sample Criteria</u>: Re-extract samples or flag sample data not meeting surrogate criteria	8270A	Surrogates spiked into method blank and all samples (QC included) <u>Method Blank and LCS Criteria</u>: All surrogates must be in control before sample analysis may proceed. <u>Sample Criteria</u>: Re-extract samples or flag sample data not meeting surrogate criteria
	Internal Standards	625	Optional, may be used for quantitation.	8270A	Internal Standards are added to all samples (QC samples included). Internal standard area of daily standard must be within -50 % to +200 % from the last daily calibration check standard. Otherwise, sample is reanalyzed.
Volatiles by GC/MS	Method Blank	624	<u>Frequency:</u> 1 with each batch of samples processed not to exceed 20 samples <u>Criteria</u>: Concentration less than reporting limit <u>Corrective Action</u>: Rerun all samples associated with unacceptable blank	8240A 8260	<u>Frequency:</u> 1 with each batch of samples processed not to exceed 20 samples <u>Criteria</u>: Concentration less than reporting limit <u>Corrective Action</u>: Rerun all samples associated with unacceptable blank

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Volatiles by GC/MS (continued)	Laboratory Control Sample	624	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8240A 8260	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte must be within historical acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS
	Matrix Spike	624	Frequency: 1 per ≤ 20 samples from each site or 1 per month, whichever is more frequent Criteria: percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike	8240A 8260	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	624	Not Applicable	8240A 8260	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	624	Not Applicable	8240A 8260	Not Applicable

TABLE 8.4-6
Organic Laboratory Quality Control Samples (Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Volatiles by GC/MS (continued)	Surrogates	624	Surrogates spiked into Method Blank and all samples (QC included) Method Blank Criteria: All surrogates must be in control before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria	8240A 8260	Surrogates spiked into Method Blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be in control before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria
	Internal Standards	624	Internal standards may be used for quantitation (optional).	8240A 8260	Internal Standards are added to all samples (QC samples included). Internal standard area of daily standard must be within -50 % to +100 % from the last daily calibration check standard. Otherwise, sample is reanalyzed.
Volatiles by GC	Method Blank	--	Not Applicable	8021	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than reporting limit Corrective Action: Rerun all samples associated with unacceptable blank
	Laboratory Control Sample	--	Not Applicable	8021	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte must be within historical acceptance limits Corrective Action: Rerun all samples associated with unacceptable LCS

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846)[2]
Volatiles by GC (continued)	Matrix Spike	--	Not Applicable	8021	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	--	Not Applicable	8021	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: percent recovery for each analyte should be within acceptance limits Corrective Action: Flag data associated with unacceptable Matrix Spike
	Duplicate	--	Not Applicable	8021	Not Applicable
	Surrogates	--	Not Applicable	8021	Surrogates spiked into method blank and all samples (QC included) Method Blank Criteria and LCS: All surrogates must be within laboratory established control limits before sample analysis may proceed. Sample Criteria: Re-extract samples or flag sample data not meeting surrogate criteria.

TABLE 8.4-6
Organic Laboratory Quality Control Samples
(Continued)

Analysis	QC Sample	Method	NPDES[1]	Method	RCRA(SW846) [2]
Volatiles by GC (continued)	Internal Standards	--	Not Applicable	8021	Optional: Internal standards are added to the method blank and all samples (QC included). If used, same compounds as used for surrogates may be appropriate.

Footnotes

(1) National Pollutant Discharge Elimination System

(2) Resource Conservation and Recovery Act (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods), third edition, Final Update I, July 1993.

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples

Analysis	QC Sample	Method	Requirement
Cyanide, Total	Method Blank	ILM03.0	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than CRDL or less than 10x sample concentration Corrective Action: Reprep all samples associated with unacceptable blank
	Laboratory Control Sample	ILM03.0	Frequency: 1 with each batch of samples processed or for each SDG, whichever is more frequent Criteria: Water - 80-120% Solid - Meet control limits established for solid reference material Corrective Action: Reprep all samples associated with unacceptable LCS
	Matrix Spike	ILM03.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG, whichever is more frequent Criteria: 75-125% unless sample result > 4x spike amount Corrective Action: Flag data associated with unacceptable Matrix Spike,. perform post distillation spike at 2xCRDL or 2x sample concentration whichever is greater
	Matrix Spike Duplicate	ILM03.0	Not Applicable
	Duplicate	ILM03.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: RPD $\leq$ 20% or $\pm$ CRDL if sample or duplicate value < 5x CRDL Corrective Action: Flag all associated data associated if duplicate results outside control limits
	Surrogates	ILM03.0	Not Applicable
	Internal Standards	ILM03.0	Not Applicable.

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
ICAP (excludes mercury)	Method Blank	ILM03.0	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than CRDL or less than 10x sample concentration Corrective Action: Reprep all samples associated with unacceptable blank
	Laboratory Control Sample	ILM03.0	Frequency: 1 with each batch of samples processed or for each SDG, whichever is more frequent Criteria: Water - 80-120% except silver and antimony Solid - Meet control limits established for solid reference material Corrective Action: Reprep all samples associated with unacceptable LCS
	Matrix Spike	ILM03.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: 75-125% unless sample result > 4x spike amount Corrective Action: Flag data associated with unacceptable Matrix perform post digestion spike at 2xCRDL or 2x sample concentration whichever is greater
	Matrix Spike Duplicate	ILM03.0	Not Applicable
	Duplicate	ILM03.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: RPD $\leq$ 20% or $\pm$ CRDL if sample or duplicate value < 5x CRDL Corrective Action: Flag all data associated with duplicate results outside control limits

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
ICAP (excludes mercury) (continued)	Serial Dilution	ILM03.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: <10% D when sample concentration > 50x IDL Corrective Action: Flag all data associated with results outside control limits
	Surrogates	ILM03.0	Not Applicable
	Internal Standards	ILM03.0	Not Applicable.
GFAA (excludes mercury)	Method Blank	ILM03.0	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than CRDL or less than 10x sample concentration Corrective Action: Reprep all samples associated with unacceptable blank
	Laboratory Control Sample	ILM03.0	Frequency: 1 with each batch of samples processed or for each SDG, whichever is more frequent Criteria: Water - 80-120% except silver and antimony Solid - Meet control limits established for solid reference material Corrective Action: Reprep all samples associated with unacceptable LCS
	Matrix Spike	ILM03.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: 75-125% unless sample result > 4x spike amount Corrective Action: Flag data associated with unacceptable Matrix
	Matrix Spike Duplicate	ILM03.0	Not Applicable

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
GFAA (excludes mercury) (continued)	Duplicate	ILM03.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: RPD ≤ 20% or ± CRDL if sample or duplicate value < 5x CRDL Corrective Action: Flag all associated data associated if duplicate results outside control limits
	Analytical Spike	ILM03.0	Frequency: 1 with each sample except matrix spike Criteria: Evaluate per method requirements Corrective action: Perform per method requirements
	Surrogates	ILM03.0	Not Applicable
	Internal Standards	ILM03.0	Not Applicable.
Mercury (CVAA)	Method Blank	ILM03.0	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than CRDL Corrective Action: Reprep all samples associated with unacceptable blank
	Laboratory Control Sample	ILM03.0	Frequency: 1 with each batch of samples processed or for each SDG, whichever is more frequent Criteria: Water - 80-120% Solid - Meet control limits established for solid reference material Corrective Action: Reprep all samples associated with unacceptable LCS
	Matrix Spike	ILM03.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG Criteria: 75-125% unless sample result > 4x spike amount Corrective Action: Flag data associated with unacceptable Matrix Spike

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Mercury (CVAA) (continued)	Matrix Spike Duplicate	ILM03.0	Not Applicable
	Duplicate	ILM03.0	Frequency: 1 with each group of samples of a similar matrix type and concentration or for each SDG whichever is more frequent Criteria: RPD ≤ 20% or ± CRDL if sample or duplicate value < 5x CRDL Corrective Action: Flag all associated data associated if duplicate results outside control limits
	Surrogates	ILM03.0	Not Applicable
	Internal Standards	ILM03.0	Not Applicable.
PCDD, PCDF	Method Blank	DFLM01.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Chemical interference or electronic noise must be less than 5% of the appropriate internal standard ion A peak that meets identification criteria must be less than 2% of the signal of the appropriate internal standard ion Corrective Action: Reprep all samples with positive results or those not meeting all identification criteria associated with unacceptable blank
	Laboratory Control Sample	DFLM01.1	Not Applicable
	Matrix Spike	DFLM01.1	Frequency: 1 for each matrix analyzed for each SDG Criteria: 50-150% Corrective Action: Verify all calculations and spiking; no further action required
	Matrix Spike Duplicate	DFLM01.1	Not Applicable

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
PCDD, PCDF (continued)	Duplicate	DFLM01.1	Frequency: 1 for each matrix analyzed for each SDG Criteria: RPD ≤ 50% Corrective Action: Verify all calculations and spiking; no further action required
	Surrogates	DFLM01.1	Not Applicable
	Internal Standards	DFLM01.1	Frequency: Internal standards are spiked into all samples and QC samples Criteria: 25-150% Corrective Action: Reextract and reanalyze all samples with unacceptable surrogate recoveries
Pesticides/PCBs	Method Blank	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples),for each extraction procedure within each SDG, whichever is most frequent or whenever samples are extracted Criteria: Concentration less than CRQL Corrective Action: Reextract and reanalyze all samples associated with unacceptable blank
	Laboratory Control Sample	OLM03.1	Not Applicable.
	Matrix Spike	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each extraction procedure or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike recoveries

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Pesticides/PCBs (continued)	Matrix Spike Duplicate	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method RPD between MS/MSD should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike recoveries or RPD
	Duplicate	OLM03.1	Not Applicable
	Surrogates	OLM03.1	Frequency: Surrogates spiked into all samples and QC samples Criteria: Percent recovery for each surrogate in samples should be within 30-150% Percent recovery for each surrogate in the method blank must be 30-150% Corrective Action: Flag unacceptable surrogate recoveries in samples Reextract all samples associated with unacceptable surrogate recoveries in the method blank
	Internal Standards	OLM03.1	Not Applicable.
Semivolatiles by GC/MS	Method Blank	OLM03.1	Frequency: 1 with each batch of samples processed not to exceed 20 samples Criteria: Concentration less than CRQL except phthalates which must be $\leq$ 5x CRQL Corrective Action: Reextract and reanalyze all samples associated with unacceptable blank
	Laboratory Control Sample	OLM03.1	Not Applicable.

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Semivolatiles by GC/MS (continued)	Matrix Spike	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method RPD between MS/MSD should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike recoveries or RPD
	Duplicate	OLM03.1	Not Applicable
	Surrogates	OLM03.1	Frequency: Surrogates spiked into all samples and QC samples Criteria: Percent recovery for each surrogate must be within limits given in method (one base/neutral and/or one acid surrogate may be outside of limits but not below 10%) Corrective Action: Flag data associated with unacceptable recoveries or reanalyze all samples with unacceptable surrogate recoveries as required in method
	Internal Standards	OLM03.1	Frequency: Internal Standards are spiked into all samples and QC samples Criteria: Internal Standard areas must be within -50% to + 100% from the last daily calibration check standard Corrective Action: Reanalyze all samples with unacceptable areas

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Volatiles by GC/MS	Method Blank	OLM03.1	Frequency: 1 per 12 hours Criteria: Concentration less than CRQL except methylene chloride, acetone, 2-butanone must be ≤ 5x CRQL Corrective Action: Reanalyze all samples associated with unacceptable blank
	Laboratory Control Sample	OLM03.1	Not Applicable
	Matrix Spike	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike
	Matrix Spike Duplicate	OLM03.1	Frequency: 1 with each case of samples received (up to 20 samples), for each concentration level (soils) or for each SDG, whichever is most frequent Criteria: Percent recovery for each analyte should be within advisory limits given in method RPD between MS/MSD should be within advisory limits given in method Corrective Action: Flag data associated with unacceptable Matrix Spike recoveries or RPD
	Duplicate	OLM03.1	Not Applicable
	Surrogates	OLM03.1	Frequency: Surrogates spiked into all samples and QC samples Criteria: Percent recovery for each surrogate be within limits given in method Corrective Action: Reanalyze all samples with unacceptable surrogate recoveries

TABLE 8.4-7
USEPA Contract Laboratory Program Statement of Work Quality Control Samples (Continued)

Analysis	QC Sample	Method	Requirement
Volatiles by GC/MS (continued)	Internal Standards	OLM03.1	Frequency: Internal Standards are spiked into all samples and QC samples Criteria: Internal Standard areas must be within -50% to + 100% from the last daily calibration check standard Corrective Action: Reanalyze all samples with unacceptable areas
	Storage Blank	OLM03.1	Frequency: 1 per SDG Criteria: Concentration less than CRQL except methylene chloride, acetone, 2-butanone must be ≤ 5x CRQL Corrective Action: Narrate with corrective action plan

SDG = Sample Delivery Group

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Acidity	Water	100 mL	305.1	250 mL plastic or glass, Cool, 4°C, 14 days	---	Not Applicable
	Solid[5]	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Alkalinity	Water	100 mL	310.1	250 mL plastic or glass, Cool, 4°C, 14 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Ammonia	Water	400 mL	350.1	500 mL plastic or glass, Cool, 4°C H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Biochemical Oxygen Demand (BOD)	Water	200 mL	405.1	1000 mL plastic or glass, Cool, 4°C 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Bromide	Water	100 mL	300.0[7] 320.1	250 mL plastic or glass, No preservative required, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Chemical Oxygen Demand (COD)	Water	100 mL	410.4	250 mL glass or plastic, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Chloride	Water	50 mL	300.0[7] 325.1	250 mL plastic or glass, No preservative required, 28 days	9251	250 mL plastic or glass, No preservative required, 28 days

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Chloride (continued)	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Chromium (Cr^{+6})	Water	100 mL	218.4	200 mL plastic or glass, Cool, 4°C, 24 hours	7196A	200 mL plastic or glass, Cool, 4°C, 24 hours
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Color	Water	100 mL	110.2	250 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Cyanide (Amenable)	Water	lL	335.1	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[8] Cool, 4°C, 14 days unless sulfide is present. Then maximum holding time is 24 hours	9010A 9012	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[8] Cool, 4°C, 14 days
	Solid	50g	---	Not Applicable	9010A, 9012	Not Specified
	Waste	50g	---	Not Applicable	9010A, 9012	Not Specified
Cyanide (Total)	Water	lL	335.1 335.2 335.3	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[6] Cool, 4°C, 14 days unless sulfide is present. Then maximum holding time is 24 hours	9010A 9012	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[6] Cool, 4°C, 14 days
	Solid	50g	--	Not Applicable	9010A 9012	8 or 16 oz glass Teflon-lined lids, Cool, 4°C, 14 days

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3] Method	NPDES[2], [3] Requirements	RCRA (SW846)[3], [4] Method	RCRA (SW846)[3], [4] Requirements
Cyanide (Total) (continued)	Waste	50g	--	Not Applicable	9010A, 9012	8 or 16 oz glass Teflon-lined lids, Cool, 4°C
Flashpoint (Ignitability)	Liquid	Not Applicable	---	Not Applicable	1010	No requirements, 250 mL amber glass, Cool, 4°C is recommended
	Solid	Not Applicable	--	Not Applicable	---	Not Applicable
	Waste	Not Applicable	--	Not Applicable	---	Not Applicable
Fluoride	Water	300 mL	340.2	500 mL plastic, No preservation required, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Hardness (Total)	Water	50 mL	200.7	250 mL glass or plastic, Cool, 4°C, HNO_3 to pH < 2, 6 months	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Iodide	Water	100 mL	Dionex[7]	100 mL plastic or glass, Cool, 4°C, 24 hours		Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Methylene Blue Active Substances (MBAS) (Surfactant)	Water	100 mL	425.1	250 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Nitrogen, Nitrate	Water	100 mL	352.1	250 mL plastic or glass, Cool, 4°C, H_2SO_4 to pH < 2 24 hours unpreserved 14 days, preserved	9200	Cool, 4°C, plastic or glass 48 hours

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size(1)	NPDES(2),(3)		RCRA (SW846)(3),(4)	
			Method	Requirements	Method	Requirements
Nitrogen, Nitrate (continued)	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	9200	Not Specified
Nitrogen, Nitrite	Water	50 mL	354.1	250 mL plastic or glass Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Nitrogen, Nitrate-Nitrite	Water	100 mL	353.2 353.3	250 mL plastic or glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	9200 (nitrate)	Nitrate - Cool, 4°C, plastic or glass, 48 hours
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Odor	Water	IL	140.1	200 mL glass only, Cool, 4°C, 24 hours		Not Applicable
	Solid	Not Applicable	--	Not Applicable	---	Not Applicable
	Waste	Not Applicable	--	Not Applicable	---	Not Applicable
Oil and Grease	Water	IL	413.1 413.2	1 liter glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	9070	1 liter glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days
	Solid	20g	--	Not Applicable	9071	8 oz glass with Teflon-lined lid, Holding Time Not Specified

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times
(Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method	Requirements
Oil and Grease (continued)	Waste	20g	--	Not Applicable	9071	8 oz glass with Teflon-lined lid, Holding Time Not Specified
Ortho-phosphate	Water	50 mL	365.3	100 mL plastic or glass, Filter on site Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
pH	Water	50 mL	150.1	100 mL plastic or glass. Analyze immediately. **This test should be performed in the field.**	9040	100 mL plastic or glass. Analyze immediately. **This test should be performed in the field.**
	Solid		---	Not Applicable	9045A	4 oz glass or plastic, Cool, 4°C, Analyze as soon as possible.
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Phenolics	Water	100 mL	420.1 420.2	500 mL glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	9065	1 liter glass recommended, Cool, 4°C, H_2SO_4 to pH < 2, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	9065	Not Specified
Phosphorus (Total)	Water	50 mL	365.4	100 mL plastic or glass, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Reactivity (Cyanide and Sulfide) (continued)	Water	Not Applicable	---	Not Applicable	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	10 g	---	Not Applicable	Chapter 7 Section 7.3.3 and 7.3.4	10 oz amber glass, Cool, 4°C, no headspace, analyze as soon as possible.
Residual Chlorine	Water	100 mL	330.1	250 mL glass or plastic, Cool, 4°C, analyze immediately	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Settleable Solids	Water		160.2	1000 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Silica, Dissolved	Water		200.7	Plastic only, 100 mL, Cool, 4°C, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Specific Conductance	Water	50 mL	120.1	250 mL plastic or glass, Cool, 4°C, 28 days	9050	250 mL plastic or glass, Cool, 4°C, 24 hours
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Sulfate (SO_4)	Water	100 mL	300.0 375.1	100 mL plastic or glass, Cool, 4°C, 28 days	9038	100 mL plastic or glass, Cool, 4°C, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2],[3]		RCRA (SW846)[3],[4]	
			Method	Requirements	Method	Requirements
Sulfate (SO_4) (continued)	Waste		---	Not Applicable	9038	Plastic or glass, Cool, 4°C, 28 days
Sulfide	Water	100 mL	376.2	500 mL plastic or glass, Cool, 4°C, Add 2 mL zinc acetate plus NaOH to pH > 9, 7 days	9030A	500 mL plastic, no headspace, Cool, 4°C, Add 2 mL zinc acetate plus NaOH to pH > 9, 7 days
	Solid	50 g	---	Not Applicable	9030A	Fill the surface of the solid with 2N zinc acetate until moistened. Cool, 4°C, store headspace-free
	Waste	50 g	---	Not Applicable	9030A	Fill the surface of the solid with 2N zinc acetate until moistened. Cool, 4°C, store headspace-free
Sulfite (SO_3)	Water	100 mL	377.1	100 mL plastic or glass, No preservative required, analyze immediately	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Temperature	Water		170.1	1 liter plastic or glass, analyze immediately in the field	---	Not Applicable
	Solid	Not Applicable	--	Not Applicable	--	Not Applicable
	Waste	Not Applicable	--	Not Applicable	--	Not Applicable
Total Dissolved Solids	Water	100 mL	160.1	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size(1)	NPDES(2), (3) Method	NPDES(2), (3) Requirements	RCRA (SW846)(3), (4) Method	RCRA (SW846)(3), (4) Requirements
Total Dissolved Solids (continued)	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Kjeldahl Nitrogen (TKN)	Water	500 mL	351.2	500 mL plastic or glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Organic Carbon (TOC)	Water	100 mL	415.1	100 mL plastic or glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	9060	100 mL plastic or glass, Cool, 4°C, H_2SO_4 or HCl to pH < 2, 28 days
	Solid	Not Applicable	---	Not Applicable	9060	Not Specified
	Waste	Not Applicable	---	Not Applicable	9060	Not Specified
Total Organic Halides (TOX)	Water	200 mL	---	Not Applicable	9020A	500 mL amber glass, Teflon-lined lid, Cool, 4°C, H_2SO_4 to pH < 2, no headspace, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Solids	Water	100 mL	160.3	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Total Suspended Solids	Water	100 mL	160.2	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Volatile Solids	Water	100 mL	160.4	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Turbidity	Water	50 mL	180.1	250 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
GFAA (excludes Hg)	Water	100 mL	200 series	1 liter glass or polyethylene container, HNO_3 to pH ≤ 2, 6 months	7000 series	1 liter glass or polyethylene container, HNO_3 to pH ≤ 2, 6 months
	Solid	200 g	---	Not Applicable	7000 series	8 or 16 oz glass or polyethylene container, Cool, 4°C, 6 months
	Waste	200 g	---	Not Applicable	7000 series	8 or 16 oz glass or polyethylene container, Cool, 4°C, 6 months
ICAP (excludes mercury)	Water	100 mL	200.7	1 liter glass or polyethylene container, HNO_3 to pH ≤ 2, 6 months	6010A	1 liter glass or polyethylene container, HNO_3 to pH ≤ 2, 6 months

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
ICAP (excludes mercury) (continued)	Solid	200 g	--	1 liter glass or polyethylene container, 6 months	6010A	8 or 16 oz glass or polyethylene container, Cool, 4°C, 6 months
	Waste	200 g	---	Not Applicable	6010A	8 or 16 oz glass or polyethylene container, Cool, 4°C, 6 months
Mercury (CVAA)	Water	100 mL	245.1	1 liter glass or polyethylene container, Cool, 4°C HNO_3 to pH ≤ 2, 28 days	7470	1 liter glass or polyethylene container, HNO_3 to pH ≤ 2, 13 days plastic, 38 days glass
	Solid	200 g	245.5	8 or 16 oz glass or polyethylene container, Cool, 4°C, 28 days	7471	8 or 16 oz glass or polyethylene container, Cool, 4°C, Holding Time Not Specified
	Waste	200 g	--	Not Applicable	7471	8 or 16 oz glass or polyethylene container, Cool, 4°C, Holding Time Not Specified

TABLE 8.5-1
Inorganic Sample Containers, Preservatives, and Holding Times (Continued)

Footnotes

(1) Minimum sample size indicates sample amount needed for a single analysis. Matrix spikes or duplicates will require an additional sample amount of at least this amount for each additional QC sample aliquot required.

(2) National Pollutant Discharge Elimination System - MCAWW, March 1983.

(3) Holding times are calculated from date of collection.

(4) Resource Conservation and Recovery Act (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd edition, Final Update I, July 1992).

(5) Solid matrix type includes soil, sediment, sludge and other solid materials not classified as waste.

(6) Not applicable: No method reference specified for this matrix type.

(7) Method not listed in 40CFR Part 136.

(8) Samples to be analyzed for cyanide should be field-tested for residual chlorine. If residual chlorine is detected, ascorbic acid should be added.

(9) Not specified: No holding time given for this matrix type in referenced method.

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Aromatic Volatiles	Water	40 mL	602	40 mL glass, VOA vial (in triplicate) with Teflon-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 7 days with pH > 2, 14 days with pH ≤ 2	8020A	40 mL glass, VOA vial (in triplicate) with Teflon-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, HCl or H_2SO_4 or solid $NaHSO_4$ to pH ≤ 2, 14 days with pH ≤ 2
	Solid[5]	10 g	--	Not Applicable	8020A	4 or 8 oz glass with Teflon-lined lid, Cool, 4°C, 14 days
	Waste	10 g	--	Not Applicable	8020A	4 or 8 oz glass with Teflon-lined lid, Cool, 4°C, 14 days
Dioxins/ Dibenzo-furans	Water	1L	613	1 liter amber glass with Teflon-lined lid, Cool, 4°C, Extraction, 7 days Analysis, 40 days	8280	1 liter glass amber with Teflon-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of collection
	Solid	10 g	--	Not Applicable	8280	8 or 16 oz glass amber wide mouth with Teflon-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of collection
	Waste	10 g	--	Not Applicable	8280	8 or 16 oz glass amber wide mouth with Teflon-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of collection

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Dioxins/ Dibenzo-furans	Water	1L	613	1 liter amber glass with Teflon-lined lid, Cool, 4°C, Extraction, 7 days Analysis, 40 days	8290	1 liter glass amber with Teflon-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of extraction
	Solid	10 g	--	Not Applicable	8290	8 or 16 oz glass amber wide mouth with Teflon-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of extraction
	Waste	10 g	--	Not Applicable	8290	8 or 16 oz glass amber wide mouth with Teflon-lined lid, Cool, 4°C, Extraction, 30 days Analysis, 45 days from date of extraction
Halogenated Volatiles	Water	40 mL	--	Not Applicable	8021A	40 mL glass, VOA vial (in triplicate) with Teflon-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, HCl or H_2SO_4 or solid $NaHSO_4$ to pH $\leq$ 2, 14 days with pH $\leq$ 2
	Solid[5]	10 g	--	Not Applicable	8021A	4 or 8 oz glass with Teflon-lined lid, Cool, 4°C, 14 days
	Waste	10 g	--	Not Applicable	8021A	4 or 8 oz glass with Teflon-lined lid, Cool, 4°C, 14 days

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2, 3]		RCRA (SW846)[3, 4]	
			Method	Requirements	Method[6]	Requirements
Herbicides	Water	1L	615	1 liter amber glass with Teflon-lined lid, Sodium thiosulfate or ascorbic acid if residual chlorine present, Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction	8150B	1 liter amber glass with Teflon-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction
	Solid	50 g	--	Not Applicable	8150B	4 or 8 oz glass widemouth with Teflon-lined lid, no preservative required, Extraction, 14 days Analysis, 40 days after extraction
	Waste	50 g	--	Not Applicable	8150B	4 or 8 oz glass widemouth with Teflon-lined lid. No preservative required. Extraction, 14 days Analysis, 40 days after extraction
Nitroaromatics	Water	1L	--	Not Applicable	8330	1 liter amber glass with Teflon-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction
	Solid	50 g	---	Not Applicable	8330	4 or 8 oz glass widemouth with Teflon-lined lid Cool, 4°C

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Nitroaromatics (continued)	Waste	50 g	---	Not Applicable	8330	4 or 8 oz glass widemouth with Teflon-lined lid no preservative required
Organo-phosphorus Pesticides	Water	1L	---	Not Applicable	8140	1 liter amber glass with Teflon-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction
	Solid	50 g	---	Not Applicable	8140	4 or 8 oz glass widemouth with Teflon-lined lid Cool, 4°C
	Waste	50 g	---	Not Applicable	8140	4 or 8 oz glass widemouth with Teflon-lined lid no preservative required
Polyaromatic Hydrocarbons	Water[4]	1L	610	1 liter amber glass with Teflon-lined lid, Adjust pH to 5-9 if extraction not to be done within 72 hours of sampling. Add sodium thiosulfate if residual chlorine present. Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction	8100	1 liter amber glass with Teflon-lined lid, If residual chlorine present, add 3 mL sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction
	Solid	50 g	---	Not Applicable	8100	4 or 8 oz glass widemouth with Teflon-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days after extraction

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Polyaromatic Hydrocarbons (continued)	Waste	50 g	---	Not Applicable	8100	4 or 8 oz glass widemouth with Teflon-lined lid, no preservative required, Extraction, 14 days Analysis, 40 days after extraction
Polyaromatic Hydrocarbons	Water	1L	---	Not Applicable	8310	1 liter amber glass with Teflon-lined lid, If residual chlorine present, add 3 mL sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction
	Solid	50 g	---	Not Applicable	8310	4 or 8 oz glass widemouth with Teflon-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days after extraction
	Waste	50 g	---	Not Applicable	8310	4 or 8 oz glass widemouth with Teflon-lined lid, no preservative required, Extraction, 14 days Analysis, 40 days after extraction

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Pesticides/ PCBs	Water[4]	1L	608	1 liter amber glass with Teflon-lined lid, Adjust pH to 5-9 if extraction not to be done within 72 hours of sampling. Add sodium thiosulfate if residual chlorine present and aldrin is being determined. Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction	8080A	1 liter amber glass with Teflon-lined lid, If residual chlorine present, add 3 mL 10% sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction
	Solid	50 g	---	Not Applicable	8080A	4 or 8 oz glass widemouth with Teflon-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days after extraction
	Waste	50 g	---	Not Applicable	8080A	4 or 8 oz glass widemouth with Teflon-lined lid, no preservative required, Extraction, 14 days Analysis, 40 days after extraction
Petroleum Hydrocarbons	Water[4]	1L	418.1	1 liter amber glass with Teflon-lined lid, pH $\leq$ 2 with H_2SO_4. Cool, 4°C, 28 days	---	Not Applicable
	Solid	---	---	Not Applicable	---	Not Applicable
	Waste	---	---	Not Applicable	---	Not Applicable

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size(1)	NPDES(2), (3)		RCRA (SW846)(3), (4)	
			Method	Requirements	Method(6)	Requirements
Purgeable Halocarbons	Water(4)	40 mL	601	40 mL glass VOA vial (in triplicate) with Teflon-lined septa with no headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine present, 14 days	8010B	40 mL glass VOA vial (in triplicate) with Teflon-lined septa with no headspace, Cool, 4°C, HCl or H_2SO_4 or solid $NaHSO_4$ to pH ≤ 2, sodium thiosulfate if residual chlorine present, 14 days
	Solid	10 g	---	Not Applicable	8010B	4 or 8 oz glass container with Teflon-lined lid, Cool, 4°C, 14 days
	Waste	10 g	---	Not Applicable	8010B	4 or 8 oz glass container with Teflon-lined lid, no preservative required, 14 days
Semivolatiles	Water(4)	1L	625	1 liter amber glass with Teflon-lined lid, Cool, 4°C, Extraction, 7 days Analysis, 40 days	8270A	1 liter amber glass with Teflon-lined lid, If residual chlorine present, add 3 mL sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction
	Solid	50 g	---	Not Applicable	8270A	8 or 16 oz glass wide mouth with Teflon-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days after extraction

TABLE 8.5-2
Organic Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3] Method	NPDES[2], [3] Requirements	RCRA (SW846)[3], [4] Method[6]	RCRA (SW846)[3], [4] Requirements
Semivolatiles (continued)	Waste	50 g	---	Not Applicable	8270A	8 or 16 oz glass wide mouth with Teflon-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days after extraction
Volatile Organics	Water	40 mL	624	40 mL glass, VOA vial (in triplicate) with Teflon-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 7 days with pH > 2, 14 days with pH ≤ 2	8240A, 8260	40 mL glass, VOA vial (in triplicate) with Teflon-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, HCl or H_2SO_4 or solid $NaHSO_4$ to pH ≤ 2, 14 days with pH ≤ 2
	Solid[5]	10 g	--	Not Applicable	8240A, 8260	4 or 8 oz glass with Teflon-lined lid, Cool, 4°C, 14 days
	Waste	10 g	--	Not Applicable	8240A, 8260	4 or 8 oz glass with Teflon-lined lid, Cool, 4°C, 14 days

Footnotes

(1) Minimum sample size indicates sample amount needed for a single analysis. Matrix spikes or duplicates will require an additional sample amount of at least this amount for each additional QC sample aliquot required.
(2) National Pollutant Discharge Elimination System - 40 CFR Part 136, Appendix A.
(3) Holding times are calculated from the date of collection.
(4) Resource Conservation and Recovery Act (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd edition, Final Update I, July 1992).
(5) Solid matrix type includes soil, sediment, sludge or other solids not classified as waste.
(6) Only one determination method is listed when separate methods are required for preparation and analysis.

TABLE 8.5-3
Radiological Sample Containers, Preservatives, and Holding Times

Analytical Parameters	Matrix	Recommended Containers(1)	Preservative	Maximum Holding Time	Minimum Volume Required for Analysis(2)
Gross Alpha/Beta	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	500 mls
	Soil	P, G	None		50(4) gms
Americium-241	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000(5) mls
	Soil	P, G	None		50(4) gms
Carbon-14	Water	P, G	Field adjusted to pH > 9 with NaOH(3)	180 days after collection	100 mls
	Soil	P, G	None		50(4) gms
Calcium-45	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	100 mls
Curium-242	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000(5) mls
	Soil	P, G	None		50(4) gms
Gamma Emitters Actinides, as applicable, Co-60, Cs-137, K-40, Mn-54, and other fission/activation products	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000(5) mls
	Soil	P, G	None		650(7) gms
Iron-55	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	50 mls
Lead-210	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	500 mls
	Soil	P, G	None		50(4) gms
Neptunium-237	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000(5) mls
	Soil	P, G	None		50(4) gms

TABLE 8.5-3
Radiological Sample Containers, Preservatives, and Holding Times (Continued)

Analytical Parameters	Matrix	Recommended Containers(1)	Preservative	Maximum Holding Time	Minimum Volume Required for Analysis(2)
Promethium-147	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	250 mls
Plutonium-238, 239/240	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000(5) mls
	Soil	P, G	None		50(4) gms
Radium-226	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000(5) mls
	Soil	P, G	None		50(4) gms
Radium-228	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000(5) mls
	Soil	P, G	None		50(4) gms
Strontium-89, 90 and Total Strontium	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000(5) mls
	Soil	P, G	None		50(4) gms
Technetium-99	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	100 mls
	Soil	P, G	None		50(4) gms
Throium-227, 228, 230, 232	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000(5) mls
	Soil	P, G	None		50(4) gms
Total Uranium	Water	P,G	Field acidified to pH < 2 with HNO_3	180 days after collection	50 mls
	Soil	P, G	None		50(4) gms
Tritium	Water	P, G(6)	None	180 days after collection	100 mls
	Soil	P, G(6)	None		100 gms
Uranium-233/234, 235/236	Water	P, G	Field acidified to pH < 2 with HNO_3	180 days after collection	1000(5) mls
	Soil	P, G	None		50(4) gms
Uranium-238	Soil	P, G	None	180 days after collection	50(4) gms

TABLE 8.5-3
Radiological Sample Containers, Preservatives, and Holding Times (Continued)

Footnotes

(1) Plastic (polyethylene), Glass

(2) Assumes that quality control samples have been assigned in the field. If duplicates, matrix spikes and/or matrix spike duplicates are to be assigned by the laboratory, additional multiple sample volumes are required. Volumes listed are for standard aliquot size. Detection limit requirements may necessitate larger volumes.

(3) Assumes that carbon is in the form of CO_3^{--}.

(4) May be aliquoted or sequentially determined from the same volume.

(5) May be aliquoted or sequentially determined from the same volume.

(6) Tritium is very volatile. Sample containers must be air tight to eliminate tritium loss.

(7) Dry weight.

TABLE 8.5-4
Sample Containers, Preservatives, and Holding Times for USEPA Contract Laboratory Program Statement of Work

Analytical Parameters	Matrix	Minimum Sample Size	Requirements[1]
Cyanide, Total and Amenable to Chlorination	Water	500 mL	500 mL, glass or polyethylene container, 0.6 g ascorbic acid (only in presence of residual chlorine) NaOH to pH > 12, Cool, 4°C, 12 days
	Soil/Sediment	25 g	8 or 16 oz glass with Teflon-lined lids, Cool, 4°C, 12 days
ICAP and GFAA (excludes mercury)	Water	100 mL	1 liter glass or polyethylene container, HNO_3 to pH ≤2, 180 days
	Soil/Sediment	25 g	4 or 8 oz glass or polyethylene container, Cool, 4°C, 180 days
Mercury (CVAA)	Water	100 mL	1 liter glass or polyethylene container, HNO_3 to pH ≤2, 26 days
	Soil/Sediment	25 g	8 or 16 oz glass with Teflon-lined lids, Cool, 4°C, 26 days
Pesticides/PCBs	Water	1 L	1 liter amber glass with Teflon-lined lid, Cool, 4°C, Extraction within 5 days of sample receipt Analysis within 40 days after start of extraction
	Soil/Sediment	50 g	8 or 16 oz glass widemouth with Teflon-lined lid, *protect from light,* Cool, 4°C, Extraction within 10 days of sample receipt Analysis within 40 days after start of extraction
PCDD, PCDF[2]	Water	1 L	1 liter amber glass with Teflon-lined lid, Cool, 4°C, No holding time requirements specified
	Soil/Sediment/ Fly Ash/ Chemical Waste	25 g	4 or 8 oz glass widemouth with Teflon-lined lid, protect from light, room temperature, No holding time requirements specified

TABLE 8.5-4
Sample Containers, Preservatives, and Holding Times for USEPA Contract Laboratory Program Statement of Work (Continued)

Analytical Parameters	Matrix	Minimum Sample Size	Requirements[1]
Semivolatiles	Water	1L	1 liter amber glass with Teflon-lined lid, Cool, 4°C, Extraction within 5 days of sample receipt Analysis within 40 days after start of extraction
	Soil/Sediment	50 g	8 or 16 oz glass widemouth with Teflon-lined lid, Cool, 4°C, Extraction within 10 days of sample receipt Analysis within 40 days after start of extraction
Volatiles	Water	40 mL	40 mL glass with Teflon-lined lid, no entrapped air bubbles pH <2, Cool, 4°C, 10 days
	Soil/Sediment	25 g	4 or 8 oz glass with Teflon-lined lids, Cool, 4°C, 10 days

Footnotes

(1) Holding times are calculated from verified time of sample receipt.

(2) PCDD: Polychlorinated Dibenzo-p-dioxins
PCDF: Polychlorinated Dibenzofurans

TABLE 8.5-5
Sample Containers, Preservatives, and Holding Times for TCLP

Analytical Parameters	Matrix	Minimum Sample Size[1]	Requirements: From Field Collection to TCLP Extraction	Requirements: From TCLP Extraction to Analysis
Mercury	Waste	1L	1L glass, Cool, 4°C, 28 days	Glass or polyethylene 28 days
Metals (except mercury)	Waste	1L	1L glass, Cool, 4°C, 180 days	Glass or polyethylene 180 days
Semivolatiles	Waste	1L	1L glass, Cool 4°C, 14 days	1L glass Extraction of leachate within 7 days of TCLP extraction, Analyze extract within 40 days
Volatiles	Waste	6 oz	4 oz glass, Cool 4°C, 14 days	40 mL glass, 14 days

Footnotes

[1] Smaller sample size is adequate for solid samples or individual fractions. A combined volume of 32 oz. is recommended for semivolatiles and metals. A separate 4 oz. container should always be used for the volatile fraction. Volatile fractions should be stored with minimal headspace.

TABLE 8.5-6
Periodic Equipment Calibrations

Type of Equipment	Calibration Requirements
Balances	• Must be serviced and calibrated annually by a manufacturer's representative • Calibration must be checked daily or before use by analyst with weight(s) classified as Class "S" (or Class "S" traceable) by NIST per operation-specific SOPs. Acceptance criteria vary according to weight used and accuracy of balance. Acceptance criteria must be documented in log. • Quarterly calibrations must cycle through the range of weights applicable to a balance as described in operation-specific SOPs. • All Class "S" weights must be certified by an outside agency every three years.
Thermometers	• Working thermometers must be calibrated against a certified NIST thermometer at least annually as described in operation-specific SOPs. • The NIST thermometer must be recertified every three years.
Refrigerators/Freezers	• Thermometers must be immersed in a liquid such as mineral oil or glycol • Temperature of units used for sample or standard storage must be checked daily as described in operation-specific SOPs. Refrigerator acceptance limits: 4°C ± 2°C Freezer acceptance limits: < - 10°C
Ovens	• Temperature of units must be checked daily or before use. • Acceptance limits vary according to use as described in operation-specific SOPs and must be documented in the temperature log.
Micropipettors	• Calibrations are checked gravimetrically as required by the operation-specific SOP. • Must be calibrated at the frequency (normally quarterly) required by the manufacturer at a minimum.
Syringes, Volumetric Glassware and Graduated Glassware	• All syringes and volumetric glassware are purchased as Class A items. • Class A items are certified by the manufacturer to be within ± 1% of the measured volume, therefore, calibration of these items by Quanterra laboratories is not required. • All analysts are trained in the proper use and maintenance of measuring devices to ensure the measurement of standards, reagents and sample volumes are within method tolerances.

TABLE 8.5-7
Summary of Inorganic Method Calibrations

		NPDES[1]		RCRA(SW846)[2]	
Analysis	Calibration	Method	Requirement	Method	Requirement
Acidity	Initial	305.1	2 point calibration of pH meter (± 0.05 pH units of true value)	--	Not Applicable
	Continuing	305.1	Not Applicable	--	Not Applicable
	Ending	305.1	Not Applicable	--	Not Applicable
Alkalinity	Initial	310.1	2 point calibration of pH meter (± 0.05 pH units of true value)	--	Not Applicable
	Continuing	310.1	Not Applicable	--	Not Applicable
	Ending	310.1	Not Applicable	--	Not Applicable
Ammonia	Initial	350.1	6 levels including blank, "r"[4] ≥ 0.995	--	Not Applicable
	Continuing	350.1	1 level or LCS every 10 samples ± 10% of true value	--	Not Applicable
	Ending	350.1	1 level or LCS every 10 samples ± 10% of true value	--	Not Applicable
Biochemical Oxygen Demand	Initial	405.1	Winkler calibration	--	Not Applicable
(BOD)	Continuing	405.1	Not Applicable	--	Not Applicable
	Ending	405.1	Not Applicable	--	Not Applicable
Bromide	Initial	300.0[3] 320.1	4 levels plus blank "r"[4] ≥ 0.995	--	Not Applicable
	Continuing	300.0[3] 320.1	1 level daily and after every 10 samples ± 10% of true value	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA(SW846)[2]	
		Method	Requirement	Method	Requirement
Bromide (continued)	Ending	300.0[3] 320.1	1 level ± 10% of true value	--	Not Applicable
Chemical Oxygen Demand (COD)	Initial	410.4	5 levels plus a blank "r"[4] ≥ 0.995	--	Not Applicable
	Continuing	410.4	1 level every 10 samples ± 10% of true value	--	Not Applicable
	Ending	410.4	1 level ± 10% of true value	--	Not Applicable
Chloride	Initial	300.0[3] 325.1	5 levels plus blank "r"[4] ≥ 0.995	9251	5 levels plus blank "r"[4] ≥ 0.995
	Continuing	300.0[3] 325.1	1 level every 10 samples ± 10% of true value	9251	1 level every 10 samples ± 10% of true value
	Ending	300.0[3] 325.1	1 level ± 10% of true value	9251	1 level ± 10% of true value
Chromium (Hexavalent) Cr^{+6}	Initial	218.4	5 levels plus blank "r"[4] ≥ 0.995	7196A	5 levels plus blank "r"[4] ≥ 0.995
	Continuing	218.4	1 level every 10 samples ± 10% of true value	7196A	1 level every 10 samples ± 10%
	Ending	218.4	1 level ± 10% of true value	7196A	1 level ± 10%
Color	Initial	110.2	3 levels plus blank	--	Not Applicable
	Continuing	110.2	1 level every 10 samples	--	Not Applicable
	Ending	110.2	1 level	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations (Continued)

Analysis	Calibration	NPDES[1]		RCRA(SW846)[2]	
		Method	Requirement	Method	Requirement
Cyanide (Amenable)	Initial	335.1	7 levels plus blank "r"[4] ≥ 0.995	9010A 9012	7 levels plus blank "r"[4] ≥ 0.995
	Continuing	335.1	1 level every 10 samples ± 10% of true	9010A 9012	1 mid-level every 10 samples ± 10 % of true value
	Ending	335.1	1 level ± 10 % of true value	9010A 9012	± 10 % of true value
Cyanide (Total)	Initial	335.1 335.2 335.3	7 levels plus blank "r"[4] ≥ 0.995	9010A 9012	7 levels plus blank "r"[4] ≥ 0.995
	Continuing	335.1 335.2 335.3	1 mid-level every 10 samples ± 10 % of true value	9010A 9012	1 mid-level every 10 samples ± 10 % of true value
	Ending	335.1 335.2 335.3	1 mid-level ± 10 % of true value	9010A 9012	± 10 % of true value
Flashpoint	Initial	--	Not Applicable	1010	p-Xylene reference standard must have flashpoint of 27.2°C ± 1.1°C
	Continuing	--	Not Applicable	1010	Not Applicable
	Ending	--	Not Applicable	1010	Not Applicable
Fluoride	Initial	340.2	6 levels "r"[4] ≥ 0.995	--	Not Applicable
	Continuing	340.2	1 mid-level every 10 samples ± 10% of true value	--	Not Applicable
	Ending	340.2	1 mid-level ± 10% of true value	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA(SW846)[2]	
		Method	Requirement	Method	Requirement
Hardness	Initial	200.7	Standardize titrant	--	Not Applicable
	Continuing	200.7	Not Applicable	--	Not Applicable
	Ending	200.7	Not Applicable	--	Not Applicable
Iodide	Initial	Dionex (3)	4 levels plus blank "r"(4) ≥ 0.995	--	Not Applicable
	Continuing	Dionex (3)	1 mid-level every 10 samples ± 10 % of true value	--	Not Applicable
	Ending	Dionex (3)	1 mid-level ± 10% of true value	--	Not Applicable
Methylene Blue Active Substances (MBAS)	Initial	425.1	4 levels plus blank "r"(4) ≥ 0.995	--	Not Applicable
	Continuing	425.1	1 level every 10 samples ± 10 % of true value	--	Not Applicable
	Ending	425.1	1 level ± 10 % of true value	--	Not Applicable
Nitrogen, Nitrate	Initial	353.2	5 levels plus a blank "r"(4) ≥ 0.995	--	Not Applicable
	Continuing	353.2	1 mid-level every 10 samples ± 10% of true value	--	Not Applicable
	Ending	353.2	1 mid-level ± 10% of true value	--	Not Applicable
Nitrogen, Nitrite	Initial	354.1	5 levels plus a blank "r"(4) ≥ 0.995	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

		NPDES[1]		RCRA(SW846)[2]	
Analysis	Calibration	Method	Requirement	Method	Requirement
Nitrogen, Nitrite (continued)	Continuing	354.1	1 mid-level every 10 samples ± 10% of true value	--	Not Applicable
	Ending		1 mid-level ± 10% of true value	--	Not Applicable
Nitrogen, Nitrate-Nitrite	Initial	353.2 353.3	5 levels plus blank "r"[4] ≥ 0.995	--	Not Applicable
	Continuing	353.2 353.3	1 level every 10 samples ± 10% of true value	--	Not Applicable
	Ending	353.2 353.3	1 mid-level ± 10% of true value	--	Not Applicable
Odor	Initial	140.1	No calibration	--	Not Applicable
	Continuing	140.1	Not Applicable	--	Not Applicable
	Ending	140.1	Not Applicable	--	Not Applicable
Oil and Grease and TPH	Initial	413.1 413.2	This is a gravimetric determination. Calibrate balance before use	9070 9071	Not Applicable
	Continuing	413.1 413.2		9070 9071	Not Applicable
	Ending	413.1 413.2		9070 9071	Not Applicable
Ortho-phosphate	Initial	365.3	5 levels plus a blank "r"[4] ≥ 0.995	--	Not Applicable
	Continuing	365.3	1 mid-level every 10 samples ± 10% of true value	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations (Continued)

Analysis	Calibration	NPDES[1]		RCRA(SW846)[2]	
		Method	Requirement	Method	Requirement
Ortho-phosphate (continued)	Ending	365.3	1 mid-level ± 10% of true value	--	Not Applicable
pH	Initial	150.1	2 level calibration (± 0.05 pH units of true value)	9040 9045A	2 point calibration (± 0.05 pH units of true value)
	Continuing	150.1	1 buffer check every 10 samples ± 5% of true value	9040 9045A	Not Applicable
	Ending	150.1	1 buffer check ± 5% of true value	9040 9045A	Not Applicable
	Other	150.1	Third point check pH 10 buffer ± 5% of true value	9040 9045A	Third point check
Phenolics	Initial	420.1 420.2	5 levels plus a blank "r"[4] ≥ 0.995	9065	5 levels plus a blank "r"[4] 0.995
	Continuing	420.1 420.2	1 mid-level every 10 samples ± 10% true value	9065	1 mid-level ± 10% true value
	Ending	420.1 420.2	1 mid-level ± 10% true value	9065	1 mid-level ± 10% true value
Phosphorous (Total)	Initial	365.4	5 levels plus blank "r"[4] ≥ 0.995	--	Not Applicable
	Continuing	365.4	1 level every 10 samples ± 10% of true value	--	Not Applicable
	Ending	365.4	1 level ± 10% of true value	--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1] Method	NPDES[1] Requirement	RCRA(SW846)[2] Method	RCRA(SW846)[2] Requirement
Reactivity	Initial	--	Not Applicable	Chap 7	See Total Cyanide and Sulfide
	Continuing	--	Not Applicable		
	Ending	--	Not Applicable		
Residual Chlorine	Initial	330.1	Standardize titrant	--	Not Applicable
	Continuing	330.1	Not Applicable	--	Not Applicable
	Ending	330.1	Not Applicable	--	Not Applicable
Settleable Solids	Initial	160.2	This is a gravimetric determination. Calibrate balance prior to analysis	--	Not Applicable
	Continuing	160.2		--	Not Applicable
	Ending	160.2		--	Not Applicable
Silica, Dissolved	Initial	200.7	3 levels plus blank "r"[4] $\geq$ 0.995	--	Not Applicable
	Continuing	200.7	1 level ± 15% of true value	--	Not Applicable
	Ending	200.7	1 level ± 15% of true value	--	Not Applicable
Specific Conductance	Initial	120.1	Standardize meter with 0.01 M KCl	9050	Not Applicable
	Continuing	120.1	1 level every 10 samples ± 10% of true value	9050	Not Applicable
	Ending	120.1	1 level ± 10% of true value	9050	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA(SW846)[2]	
		Method	Requirement	Method	Requirement
Sulfate	Initial	300.0 375.1	5 levels plus blank "r"[4] ≥ 0.995	9038	Not Applicable
	Continuing	300.0 375.1	1 mid-level after every 10 samples ± 10% of true value	9038	Not Applicable
	Ending	300.0 375.1	± 10% of true value	9038	Not Applicable
Sulfide	Initial	376.2	5 levels plus a blank "r"[4] ≥ 0.995	9030A	This is a colorimetric titration. Therefore, calibrations are not applicable.
	Continuing	376.2	1 level every 10 samples ± 10% of true value	9030A	
	Ending	376.2	± 10% of true value	9030A	
Sulfite	Initial	377.1	This is a colorimetric titration. Therefore, calibrations are not applicable.	--	Not Applicable
	Continuing	377.1		--	Not Applicable
	Ending	377.1		--	Not Applicable
Temperature	Initial	170.1	Not Applicable	--	Not Applicable
	Continuing	170.1	Not Applicable	--	Not Applicable
	Ending	170.1	Not Applicable	--	Not Applicable
Total Dissolved Solids	Initial	160.1	This is a gravimetric determination. Calibrate balance prior to analysis	--	Not Applicable
	Continuing	160.1		--	Not Applicable
	Ending	160.1		--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA(SW846)[2]	
		Method	Requirement	Method	Requirement
Total Kjeldahl Nitrogen (TKN)	Initial	351.2	5 levels plus blank "r"[4] ≥ 0.995	--	Not Applicable
	Continuing	351.2	1 mid- level every 10 samples ± 10% of true value	--	Not Applicable
	Ending	351.2	± 10% of true value	--	Not Applicable
Total Organic Carbon (TOC)	Initial	415.1	3 levels plus blank "r"[4] ≥ 0.995	9060	3 levels plus blank "r"[4] ≥ 0.995
	Continuing	415.1	1 mid-level every 10 samples ± 10% of true value	9060	1 med-levelevery 10 samples ± 10% of true value
	Ending	415.1	± 10% of true value	9060	± 10% of true value
Total Organic Halides (TOX)	Initial	--	Not Applicable	9020A	Two instrument calibration standards daily,, ICV ± 10% of true value
	Continuing	--	Not Applicable	9020A	CCV ± 10% of true value
	Ending	--	Not Applicable	9020A	CCV ± 10% of true value
Total Solids	Initial	160.3	This is a gravimetric determination. Calibrate balance before use.	--	Not Applicable
	Continuing	160.3		--	Not Applicable
	Ending	160.3		--	Not Applicable
Total Suspended Solids	Initial	160.2	This is a gravimetric determination. Calibrate balance before use.	--	Not Applicable
	Continuing	160.2		--	Not Applicable
	Ending	160.2		--	Not Applicable

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA(SW846)[2]	
		Method	Requirement	Method	Requirement
Total Volatile Solids	Initial	160.4	This is a gravimetric determination. Calibrate balance before use.	--	Not Applicable
	Continuing	160.4		--	Not Applicable
	Ending	160.4		--	Not Applicable
Turbidity	Initial	180.1	Minimum of 1 level in each instrument range Follow manufacturer's instructions	--	Not Applicable
	Continuing	180.1	Not Applicable	--	Not Applicable
	Ending	180.1	Not Applicable	--	Not Applicable
Water Content	Initial	--	Calibrate Balance	--	Calibrate Balance
	Continuing	--	Not Applicable	--	Not Applicable
	Ending	--	Not Applicable	--	Not Applicable
GFAA Metals (excludes Hg)	Initial	200 series	3 levels plus blank "r"[4] $\geq$ 0.995	7000 series	3 levels plus blank "r"[4] $\geq$ 0.995
	Continuing	200 series	Every 10 samples $\pm$ 10% of true value	7000 series	Every 10 samples $\pm$ 20% of true value
	Ending	200 series	$\pm$ 10% of true value	7000 series	$\pm$ 20% of true value
	Other	200 series	Annually - Instrument detection limits	7000	Annually - Instrument detection limits
ICAP Metals (excludes Hg)	Initial	200.7	1 level and blank ICV: $\pm$ 10% of true value	6010A	1 level and blank Rerun high calibration standard: verify quantitation at $\pm$ 5% of true value ICV: $\pm$ 10% of true

TABLE 8.5-7
Summary of Inorganic Method Calibrations
(Continued)

Analysis	Calibration	NPDES[1]		RCRA(SW846)[2]	
		Method	Requirement	Method	Requirement
ICAP Metals (excludes Hg) (continued)	Continuing	200.7	Every 10 samples ± 5% of true value	6010A	Mid-level calibration standard Every 10 samples ± 10% of true value
	Ending	200.7	± 5% of true value	6010A	Mid-level calibration standard ± 10% of true value
	Other	200.7	ICSA, ICSAB: Analyze at beginning and end or every 8 hours whichever is more frequent Annually: ICP interelement correction factors Instrument detection limits	6010A	ICSA, ICSAB: Analyze at beginning and end or every 8 hours whichever is more frequent Annually: ICP interelement correction factors Instrument detection limits
Mercury by CVAA	Initial	245.1 245.5	5 levels plus blank "r"[4] $\geq$ 0.995	7470 7471	5 levels plus blank "r"[4] $\geq$ 0.995
	Continuing	245.1 245.5	Daily or every 10 samples, whichever is more frequent ± 20% of true value	7470 7471	Every 10 samples ± 20% of true value
	Ending	245.1 245.5	± 20% of true value	7470 7471	± 20% of original prepared standard
	Other	245.1 245.5	Annually: - Instrument detection limits	7470 7471	Annually - Instrument detection limits

Footnotes

(1) National Pollutant Discharge Elimination System

(2) Resource Conservation and Recovery Act (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

(3) Method not listed in 40CFR Part 136.

(4) "r" = correlation coefficient

TABLE 8.5-8
Summary of Organic Method Calibrations

Analytical Parameter	Calibration	NPDES[1]		RCRA(SW846) [2]	
		Method	Requirement	Method	Requirement
Aromatic Volatiles by GC	Initial	602	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8020A	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.
	Continuing	602	Analyze QC check sample and evaluate per method requirements	8020A	Mid-level calibration standard analyzed every 10 samples. Evaluate per method requirements.
	Ending	602	Not Applicable	8020A	Mid-level calibration standard Evaluate per method requirements.
	Other	602	Not Applicable	8020A	Not Applicable
Dioxins/ Dibenzo-furans by HRGC/LRMS	Initial	613	3 levels If % RSD <10%, use mean RF. Otherwise calibration curve employed	8280	5 levels in triplicate % RSD ≤ 15%
	Continuing	613	1 level each working day. % D must be ≤ 15%.	8280	1 level every 12 hours after window performance mix Standard must have RFs with %D ≤ 30% from initial
	Ending	613	Not Applicable	8280	Window performance mix

TABLE 8.5-8
Summary of Organic Method Calibrations (Continued)

Analytical Parameter	Calibration	NPDES[1]		RCRA(SW846)[2]	
		Method	Requirement	Method	Requirement
Dioxins/ Dibenzofurans by HRGC/LRMS (continued)	Other	613	Establish Single Ion Monitoring conditions described in method	8280	Window mix to set congener windows every 12 hours at beginning of sequence. Isotope ratios in standard must meet criteria in method. Valley between 2,3,7,8-TCDD[3] and 1,2,3,4-TCDD must be ≤ 25% of the 2,3,7,8-TCDD[3] peak height.
Dioxins/ Dibenzofurans by HRGC/HRMS	Initial	--	Not Applicable	8290	5 levels plus window defining solution. %RSD for natives ≤ 20% for RFs; %RSD for labeled compounds ≤ 30% for RFs.
	Continuing	--	Not Applicable	8290	1 level every 12 hours after window defining solution. RFs with %D ≤ 20% for natives; %D ≤ 30% for labeled compounds from initial
	Ending	--	Not Applicable	8290	1 level: RFs with %D ≤ 20% for natives; %D ≤ 30% for labeled compounds from initial
	Other	--	Not Applicable	8290	Isotope ratios in standard must meet criteria in method. Valley between 2,3,7,8-TCDD and all other TCDDs must be ≤ 25% of the 2,3,7,8-TCDD height

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1] Method	NPDES[1] Requirement	RCRA(SW846)[2] Method	RCRA(SW846)[2] Requirement
Herbicides by GC	Initial	615	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8150	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.
	Continuing	615	1 or more calibration standards analyzed daily % D ± 15% of predicted response	8150	Mid-level calibration standard analyzed every 10 samples. % D ± 15% of predicted response
	Ending	615	Not Applicable	8150	Mid-level calibration standard % D ± 15% of predicted response.
	Other	615	Not Applicable	8150	Not Applicable
Nitroaromatics by HPLC	Initial	--	Not Applicable	8330	Minimum of 5 levels. Curve should be linear with zero intercept.
	Continuing	--	Not Applicable	8330	Midpoint calibration standard at beginning and after the midpoint of sample run. %D ± 15% of predicted response
	Ending	--	Not Applicable	8330	Midpoint calibration standard %D: ± 15% of predicted response
	Other	--	Not Applicable	8330	Not Applicable
Polyaromatic Hydrocarbons by GC or HPLC	Initial	610	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8100	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.

TABLE 8.5-8
Summary of Organic Method Calibrations (Continued)

Analytical Parameter	Calibration	NPDES[1] Method	NPDES[1] Requirement	RCRA(SW846)[2] Method	RCRA(SW846)[2] Requirement
Polyaromatic Hydrocarbons by GC or HPLC (continued)	Continuing	610	1 or more calibration standards analyzed daily % D ± 15% of predicted response	8100	Mid-level calibration standard analyzed every 10 samples. % D ± 15% of predicted response
	Ending	610	Not Applicable	8100	Mid-level calibration standard % D ± 15% of predicted response.
	Other	610	Not Applicable	8100	Not Applicable
	Initial	--	Not Applicable	8310	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.
	Continuing	--	Not Applicable	8310	Mid-level calibration standard analyzed every 10 samples. % D ± 15% of predicted response
	Ending	--	Not Applicable	8310	Mid-level calibration standard % D ± 15% of predicted response.
	Other	--	Not Applicable	8310	Not Applicable
Pesticides/ PCBs by GC	Initial	608	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8080A	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1] Method	NPDES[1] Requirement	RCRA(SW846)[2] Method	RCRA(SW846)[2] Requirement
Pesticides/ PCBs by GC (continued)	Continuing	608	1 or more calibration standards analyzed daily % D ± 15% of predicted response	8080A	Mid-level calibration standard analyzed every 10 samples. % D ± 15% of predicted response
	Ending	608	Not Applicable	8080A	Mid-level calibration standard % D ± 15% of predicted response.
	Other	608	Not Applicable	8080A	Not Applicable
Petroleum Hydrocarbons, Total Recoverable by IR	Initial	418.1	Minimum of 3 levels plus blank "r" ≥ 0.995	--	Not Applicable
	Continuing	418.1	1 level Expected response should be within ± 15%	--	Not Applicable
	Ending	418.1	1 level Expected response should be within ± 15%	--	Not Applicable
	Other	418.1	Not Applicable	--	Not Applicable
Organophos-phorous Pesticides by GC	Initial	--	Not Applicable	8140	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.
	Continuing	--	Not Applicable	8140	Mid-level calibration standard analyzed every 10 samples. % D ± 15% of predicted response

TABLE 8.5-8
Summary of Organic Method Calibrations (Continued)

Analytical Parameter	Calibration	NPDES[1] Method	NPDES[1] Requirement	RCRA(SW846)[2] Method	RCRA(SW846)[2] Requirement
Organophos-phorous Pesticides by GC (continued)	Ending	--	Not Applicable	8140	Mid-level calibration standard % D ± 15% of predicted response.
	Other	--	Not Applicable	8140	Not Applicable
Purgeable Halocarbons by GC	Initial	601	Minimum of 3 levels If % RSD < 10%, use avg RF. Otherwise, calibration curve employed	8010B	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.
	Continuing	601	Analyze QC check sample and evaluate per method requirements	8010B	Mid-level calibration standard analyzed every 10 samples. Evaluate per method requirements.
	Ending	601	Not Applicable	8010B	Mid-level calibration standard Evaluate per method requirements.
	Other	601	Not Applicable	8010B	Not Applicable
Halogenated Volatiles by GC	Initial	--	Not Applicable	8021A	Minimum of 5 levels If % RSD < 20%, use avg RF. Otherwise, calibration curve employed.
	Continuing	--	Not Applicable	8021A	Mid-level calibration standard analyzed every 10 samples. % D ± 15% of predicted response
	Ending	--	Not Applicable	8021A	Mid-level calibration standard % D ± 15% of predicted response.

TABLE 8.5-8
Summary of Organic Method Calibrations (Continued)

Analytical Parameter	Calibration	NPDES[1] Method	NPDES[1] Requirement	RCRA(SW846)[2] Method	RCRA(SW846)[2] Requirement
Halogenated Volatiles by GC (continued)	Other	--	Not Applicable	8021A	Not Applicable
Semivolatiles	Initial	625	Minimum of 3 levels, lowest near but above MDL If % RSD $\leq$ 35%, use avg RF Otherwise calibration curve employed.	8270A	Minimum of 5 levels, % RSD for RF for CCCs[4] $\leq$ 30% SPCCs[5]: RF > 0.050
	Continuing	625	1 level every 24 hours %D < 20 % between RF from standard and avg RF from initial calibration	8270A	Mid-level standard every 12 hours (after tuning) %D for CCCs[4] < 30 % between RF from standard and avg RF from initial SPCCs[5]: RF > 0.050
	Ending	625	Not Applicable	8270A	Not Applicable
	Other	625	DFTPP[7] tuning every 24 hours before standard or sample runs. Check column performance daily with benzidine and pentachlorophenol	8270A	DFTPP[7] tuning at the beginning of every 12 hour shift.
Volatiles	Initial	624	Minimum of 3 levels, If % RSD $\leq$ 35%, can use mean RF Otherwise calibration curve employed	8240A	Minimum of 5 levels, % RSD for RF for CCCs[4] $\leq$ 30% SPCCs[5]: RF > 0.300 (0.250 for Bromoform)

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Analytical Parameter	Calibration	NPDES[1] Method	NPDES[1] Requirement	RCRA(SW846)[2] Method	RCRA(SW846)[2] Requirement
Volatiles (continued)	Continuing	624	1 level every 24 hours %D < 20 % between RF from standard and avg RF from initial calibration	8240A	Mid-level standard every 12 hours (after tuning) %D for CCCs[4] < 30 % between RF from standard and avg RF from initial SPCCs[5]: RF > 0.300 (0.250 for Bromoform
	Ending	624	Not Applicable	8240A	Not Applicable
	Other	624	BFB[6] tuning every 24 hours before standard or sample runs.	8240A	BFB[6] tuning at the beginning of every 12 hour shift.
	Initial	--	Not Applicable	8260	Minimum of 5 levels, %RSD for RF for CCCs[4] < 30% SPCCs[5]: RF > 0.300 (0.250 for Bromoform)
	Continuing	--	Not Applicable	8260	Mid-level standard every 12 hours (after tuning) %D for CCCs[4] < 25 % between RF from standard and avg RF from initial SPCCs[5]: RF > 0.300 (0.250 for Bromoform
	Ending	--	Not Applicable	8260	Not Applicable
	Other	--	Not Applicable	8260	BFB[6] tuning at the beginning of every 12 hour shift.

TABLE 8.5-8
Summary of Organic Method Calibrations
(Continued)

Footnotes

(1) National Pollutant Discharge Elimination System
(2) Resource Conservation and Recovery Act (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods)
(3) TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
(4) CCC - Continuing Calibration Compounds
(5) SPCC - System Performance Check Compound
(6) BFB - Bromofluorobenzene
(7) DFTPP - Decafluorotriphenylphosphine

TABLE 8.5-9
Summary of USEPA Contract Laboratory Program Statement of Work Method Calibrations

Analytical Parameter	Calibration	Method	Requirement
Cyanide, Total	Initial	ILM03.0	Minimum 5 plus blank "r"[(4)] $\geq$ 0.995
	Continuing	ILM03.0	1 mid-level every 10 samples ± 15 % of true value
	Ending	ILM03.0	± 15 % of true value
	Other	ILM03.0	Not Applicable
ICAP (excludes mercury)	Initial	ILM03.0	1 level and blank ICV: ± 10% of true
	Continuing	ILM03.0	Mid-level calibration standard Every 10 samples ± 10% of true value
	Ending	ILM03.0	Mid-level calibration standard ± 10% of true value
	Other	ILM03.0	ICSA, ICSAB: Analyze at beginning and end or every 8 hours whichever is more frequent CRI: Beginning and end of each run, and every 8 hours for all analytes at 2x CRDL or 2x IDL whichever is greater, except for Al, Ba, Ca, Fe, Mg, Na, K <u>Quarterly</u>: Instrument detection limits Linear Range Verification <u>Annually:</u> <u>ICP interelement correction factors</u>

TABLE 8.5-9
Summary of USEPA Contract Laboratory Program Statement of Work Method Calibrations (Continued)

Analytical Parameter	Calibration	Method	Requirement
GFAA (excludes Hg)	Initial	ILM03.0	Minimum 3 levels plus blank ICV: ± 10%
	Continuing	ILM03.0	Every 10 samples ± 10% of true value
	Ending	ILM03.0	± 10% of true value
	Other	ILM03.0	CRA: Beginning of every analytical run (no acceptance criteria) Quarterly - Instrument detection limits
Mercury (CVAA)	Initial	ILM03.0	Minimum 3 levels plus blank "r"(4) ≥ 0.995 ICV: ± 20%
	Continuing	ILM03.0	Every 10 samples ± 20% of true value
	Ending	ILM03.0	± 20% of true value
	Other	ILM03.0	Quarterly - Instrument detection limits
Pesticides/PCBs	Initial	OLM03.1	3 levels for single component analytes, 1 level for multicomponent analytes RSD must be ≤ 20% except α-BHC and δ-BHC at 25% (allow up to 2 target analytes to be 20% ≤ 30%)
	Continuing	OLM03.1	Instrument Blank and midpoint calibration or PEM every 12 hours % D: ± 25% of predicted response

TABLE 8.5-9
Summary of USEPA Contract Laboratory Program Statement of Work Method Calibrations (Continued)

Analytical Parameter	Calibration	Method	Requirement
Pesticides/PCBs	Ending	OLM03.1	Instrument Blank and midpoint calibration or PEM
(continued)	Other	OLM03.1	Resolution Check Mixture $\geq$ 60% PEM: $\geq$ 90% DDT, Endrin breakdown must each be $\leq$ 20% ($\leq$ 30% combined)
PCDD,PCDF	Initial	DFLM01.1	Minimum 5 levels Resolution: 13C12-2378-TCDD and 13C12-1234-TCDD < 25% 123478-HxCDD and 123678-HxCDD $\leq$ 50% %RSD unlabeled PCDDs/PCDFs and internal standards $\leq$ 15%
	Continuing	DFLM01.1	Analyze CC3 or CPS solution every 12 hours Must meet ion abundance, S/N, and %D criteria in method
	Ending	DFLM01.1	Analyze CC1 solution at end of 12 hour period Must meet ion abundance and S/N criteria in method
	Other	DFLM01.1	Window Defining Mix: verify switching times
Semivolatiles by GC/MS	Initial	OLM03.1	5 levels RRF and RSD must meet method criteria
	Continuing	OLM03.1	Mid-level every 12 hours after tuning check %D and RRF must meet minimum criteria
	Ending	OLM03.1	Not Applicable
	Other	OLM03.1	DFTPP tuning at the beginning of every 12 hour shift
Volatiles by GC/MS	Initial	OLM03.1	5 levels RRF and RSD must meet method criteria
	Continuing	OLM03.1	Mid-level every 12 hours after tuning check %D and RRF must meet minimum criteria
	Ending	OLM03.1	Not Applicable
	Other	OLM03.1	BFB tuning at the beginning of every 12 hour shift

TABLE 8.6-1
Precision and Accuracy Measurements

Measurement	Definition
Accuracy	The degree of agreement of a measurement with an accepted reference or true value. The only true or known values in the laboratory are spiked samples. Expressed as laboratory control sample (LCS) percent recovery (% R): $$LCS\ \%R = \frac{Found}{True} x\ 100$$ where: Found = the concentration of an analyte determined from sample analysis True = the concentration of the analyte spiked into the sample Expressed as matrix spike/matrix spike duplicate (MS/MSD) sample percent recovery (% R): $$MS\ /\ MSD\ \%R = \frac{S-U}{C} x\ 100$$ where: S = measured concentration in spiked aliquot U = measured concentration in unspiked aliquot C = acutal concentraton of spike added
Precision	The measure of analytical reproducibility of two values. Expressed as the relative percent difference (RPD) of two values. $$RPD = \left[\frac{\lvert x_1 - x_2 \rvert}{\left(\frac{x_1 + x_2}{2}\right)}\right] x\ 100$$ where: x_1 = first value x_2 = second value

TABLE 8.6-1
Precision and Accuracy Measurements
(Continued)

Measurement	Definition
Arithmetic mean	The average of a set of values. $$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$ where: $\bar{x}$ = the mean x_i = the i^{th} data value n = number of data values
Standard Deviation	A measure of the random (probable) error associated with a single measurement within a data set. $$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$ where: s = sample standard deviation $\bar{x}$ = the mean x_i = the i^{th} data value n = number of data values
Quality Control Chart	A graphical representation of analytical accuracy. Displays the arithmetic mean of a data set, the upper and lower warning limits and the upper and lower control limits.
Upper Control Limit (UCL)	$UCL = \bar{x} + 3s$
Upper Warning Limit (UWL)	$UWL = \bar{x} + 2s$
Lower Warning Limit (LWL)	$LWL = \bar{x} - 2s$
Lower Control Limit (LCL)	$LCL = \bar{x} - 3s$

TABLE 8.9-1
Instrument Maintenance Schedule
Ion Chromatograph(1)

As Needed	Daily	Weekly	Monthly	Semi-annually
Clean micromembrane suppressor when decreases in sensitivity are observed.	Check plumbing/leaks.	Check pump heads for leaks.	Check all air and liquid lines for discoloration and crimping, if indicated.	Lubricate left hand piston.
Check fuses when power problems occur.	Check gases.	Check filter (inlet)	Check/change bed supports guard and analytical columns, if indicated.	Clean conductivity cell.
Reactivate or change column when peak shape and resolution deteriorate or when retention time shortening indicates that exchange sites have become deactivated.	Check pump pressure.			Check conductivity cell for calibration.
De-gas pump head when flow is erratic.	Check conductivity meter.			

TABLE 8.9-2
Instrument Maintenance Schedule
LACHAT Auto Analyzer(1)

As Needed	Daily	Monthly	Semi-annually	Annually
Prepare fresh reagents.	Clean detector cell and make sure there are no trapped bubbles in detector cell.	Replace tubing.	Lubricate pump roller.	Clean pump rollers with steel wool and lubricate.
	Check tubing.	Clean pump, diluter, and XYZ Sampler.		
	Clean sample probe shaft.			

TABLE 8.9-3
Instrument Maintenance Schedule
Total Organic Halide Analyzer[1]

Daily	Weekly	Monthly
Check pyrolysis tube and quartz wool.	Change quartz wool in pyrolysis tube.	Examine and clean pyrolysis tube.
Check for gas bubbles in titration sidearm.	Measure gas flow.	Clean titration cell.
Check electrodes for damage; polish the electrodes.	Perform cell performance check.	Perform electronic test.
Replace cell fluid, dehydrating fluid and electrolyte if needed.		Replace agar bridge in the working electrode.
Clean quartz boat.		
Observe check valves during use for backfeed.		Replace O-rings.
At end of each day of use, wash out absorption module.		

TABLE 8.9-4
Instrument Maintenance Schedule
High Pressure Liquid Chromatograph[1]

Daily	As Needed
Check level of solution in reservoirs. If adding, verify that solvent is from the same source. If changing, rinse gas and delivery lines to prevent contamination of the new solvent.	Replace columns when peak shape and resolution indicate that chromatographic performance of column is below method requirements.
Check gas supply.	Oil autosampler slides when sample does not advance.
Backflush column.	Rinse flow cell with 1N nitric acid if sensitivity low.
Flush with an appropriate solvent to remove all bubbles.	Change pump seals when flow becomes inconsistent.
Pre-filter all samples.	Repack front end of column (~1/week).

TABLE 8.9-5
Instrument Maintenance Schedule
Flame Atomic Absorption Spectroscopy(1)

Daily	Weekly	Monthly	As Needed
Verify proper safety precautions are working.	Clean burner head.	Check background corrector for alignment.	Check drain receptacle.
Verify gas box operates properly and safely.	Clean nebulizer.	Clean all filters and fans.	
Verify sensitivity using elements in UV/VIS spectrum.	Clean spray chamber.		
	Check sample introduction O-rings.		

TABLE 8.9-6
Instrument Maintenance Schedule
Inductively Coupled Argon Plasma/Mass Spectrometry (ICAP/MS)(1)

Daily	Weekly	Monthly	Quarterly	Annually	As Needed
Check sample waste container level.	Check peristalic pump: proper roller pressure, sample introduction tubing, correct pump rotation, condition of drain tubing.	Clean all filters and fans.	Replace oil in roughing pumps.	Replace oil in turbomolecu lar pump.	Check electronic settings for optimum sensitivity: resolution, mass calibration, ion optics, CEM, deflector volatage.
Check quartz torch condition.	Check condition of sampler and skimmer cones.	Check recirculator water level.			
Measure quartz torch for proper alignment.	Check and drain oil mist eliminator on roughing pumps.				
Clean spray chamber and nebulizer.					
Check oil level of roughing pumps.					

TABLE 8.9-7
Instrument Maintenance Schedule
ICP(1)

Daily	As Needed	Semi-annually	Annually
Check that argon tank pressure is 50-60 psi and that a spare tank is available.	Clean plasma torch assembly to remove accumulated deposits.	Change vacuum pump oil.	Notify manufacturer service engineer for scheduled preventive maintenance service.
Check vacuum pump gage. (<10 millitorr)	Clean nebulizer and drain chamber; keep free-flowing to maintain optimum performance.	Replace coolant water filter. (may require more or less frequently depending on the quality of water)	
Check that cooling water supply system is full and drain bottle is not full. Also that drain tubing is clear, tight fitting and has few bends.	Clean filters on back of power unit to remove dust.		
Check that nebulizer is not clogged.	Replace when needed: peristaltic pump tubing sample capillary tubing autosampler sipper probe		
Check that capillary tubing is clean and in good condition.			
Check that peristalic pump windings are secure.			
Check that high voltage switch is on.			
Check that exhaust screens are clean.			
Check that torch, glassware, aerosol injector tube, bonnet are clean.			
Check ytrium position.			

TABLE 8.9-8
Instrument Maintenance Schedule
Graphite Furnace Atomic Absorption[1]

Daily	Monthly	Semi-annually	Annually
Check gas lines and gas supply.	Check coolant level in cooling unit. Add coolant if error message appears.	Replace contact cylinder.	Notify manufacturer service engineer to clean optics.
Clean optical windows.			
Clean contact cylinders.			
Check tubes and platform; replace if corroded, faking, or if low absorbance results.			
Adjust autosampler arm.			
PE4100ZL: clean fume extraction tip, replace fume extraction filter and H_2O trap.			
As needed, trim sampling capillary.			
Check drain lines and waste containers; empty as needed.			
Check acid rinse containers; fill as needed.			

TABLE 8.9-9
Instrument Maintenance Schedule
Cold Vapor Atomic Absorption (Leeman PS 200)[1]

Daily	Semi-annually	Annually
Clean lens.	Check Hg lamp intensity.	Change Hg lamp.
Check aperture.		Check liquid/gas separator.
Check argon flow.		
Check tubing.		
Check drain.		
Replace drying tube.		

TABLE 8.9-10
Instrument Maintenance Schedule
Cold Vapor Atomic Absorption (PE 5000)[1]

Daily	Monthly
Clean aspirator by flushing with DI water.	Clean cell in aqua regia.
Check tubing and replace if needed.	Clean aspirator in aqua regia.
Clean windows with methanol.	
Change silica gel in drying tube.	
Check argon gas supply.	
Adjust lamp.	

TABLE 8.9-11
Instrument Maintenance Schedule
Gas Chromatograph(1)

Daily	As Needed	Quarterly/Semi-annually/Annually
Check for sufficient supply of carrier and detector gases. Check for correct column flow and/or inlet pressures.	Replace front portion of column packing or break off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (e.g. peak tailing, poor resolution, high backgrounds, etc.) indicates it is required.	Quarterly ECLD: change roughing resin, clean cell assembly.
Check temperatures of injectors and detectors. Verify temperature programs.	Change glass wool plug in injection port and/or replace injection port liner when front portion of column packing is changed or front portion of capillary column is removed.	Semi-annually ECD: perform wipe test.
Check inlets, septa. When using HP7673 autosampler, change septa daily.	Replace septum (approximately every 100 injections).	Annually ELCD: change finishing resin, clean solvent filter.
Check baseline level.	Perform gas purity check (if high baseline indicates that impure carrier gas may be in use).	
Check reactor temperature of electrolytic conductivity detector.	Replace or repair flow controller if constant gas flow cannot be maintained.	
	Replace fuse.	
	Reactivate external carrier gas dryers.	
	Detectors: clean when baseline indicates contamination or when response is low. FID: clean/replace jet, replace ignitor. NPD: clean/replace collector assembly. PID: clean lamp window, replace seals. ECLD: check solvent flow weekly, change reaction tube, replace solvent, change reaction gas, clean/replace Teflon transfer line.	
	Reactivate flow controller filter dryers when presence of moisture is suespected.	

TABLE 8.9-11
Maintenance Schedule
Gas Chromatograph[1]
(Continued)

Daily	As Needed	Quarterly/Semi-annually/Annually
(continued)	HP 7673 Autosampler: replace syringe, fill wash bottle, dispose of waste bottle contents.	(continued)
	Purge & trap devices: periodic leak checks, replace/condition traps (when poor response or disappearance of reactive or poorly trapped compounds), clean sample lines, valves (if they become contaminated), clean glassware.	
	Purge & trap autosamplers: leak check system, clean sample lines, valves. PTA-30 autosampler also requires cleaning the syringes, frits, valves, and probe needles, adjustment of micro switches, replacement of Teflon valve bleck, and lubrication of components.	

TABLE 8.9-12
Instrument Maintenance Schedule
Mass Spectrometer(1)

Daily	As Needed(2)	Semi-Annually	Annually
Check for sufficient gas supply. Check for correct column flow and/or inlet pressure.	Check level of oil in mechanical pumps and diffusion pump if vacuum is insufficient. Add oil if needed between service contract maintenance.	Change oil in the mechanical rough pump. Relubricate the turbomolecular pump bearing wick.	Replace the exhaust filters on the mechanical rough pump every 1-2 years.
Check temperatures of injector, detector. Verify temperature programs.	Replace electron multiplier when the tuning voltage approaches the maximum and/or when sensitivity falls below required levels.		
Check inlets, septa.	Clean Source, including all ceramics and lenses - the source cleaning is indicated by a variety of symptoms including inability of the analyst to tune the instrument to specifications, poor response, and high background contamination.		
Check baseline level.	Repair/replace jet separator.		
Check values of lens voltages, electron multiplier, and relative abundance and mass assignments of the calibration compounds.	Replace filaments when both filaments burn out or performance indicates need for replacement.		

TABLE 8.9-13
Instrument Maintenance Schedule
TRAACS 800 Auto Analyzer [1]

As Needed	Daily	Monthly	Semi-annually	Annually
Replaces air filter when progressive loss of air pressure is observed.	Check air pressure gauge (22 ± 2 psi)	Change all pump tubes (or after 200 hours of pumping time)	(or after 1000 hours of pumping time)	Lightly lubricate the Linear Sample Rails (use semi-fluid lubricant)
Replace air valve tubing when occlusion in tubing is observed	Use recommended washout procedure (at end of analysis operations)	Clean sample probe shaft	Replace pump platens	Replace coloremeter lamp (or after 2500 hours of use)

TABLE 8.9-14
Instrument Maintenance Schedule
Sonicator [1]

Daily	As Needed
Daily when used: Inspect probe tips for inconsistencies (etching/pitting).	Replace propbe tip.
	Disassemble and clean sonicator probe tips.
	Tune sonicator assembly.

TABLE 8.9-15
Instrument Maintenance Schedule
Analytical/Top Loading Balances[1]

Daily	Annually	Semi-Annually
Daily when used: Claibrate with check weights.	Internal weight train serviced. Gears and electronics serviced.	

TABLE 8.9-16
Instrument Maintenance Schedule
Refrigerators/Walk-in Coolers[1]

Daily	As Needed
Temperatures checked and logged.	Refrigerant system and electronics serviced.

TABLE 8.9-17
Instrument Maintenance Schedule
Ovens[1]

Daily	As Needed
Temperatures checked and logged.	Electronics serviced.

TABLE 8.9-18
Instrument Maintenance Schedule
Specific Digital Ion Analyzer[1]

Daily	As Needed
Daily when used: Calibrate with check standards.	Electronics serviced.

TABLE 8.9-19
Instrument Maintenance Schedule
Turbidimeter[1]

Daily	As Needed
Daily when used: Calibrate with check standards.	Electronics serviced.

TABLE 8.9-20
Instrument Maintenance Schedule
Dissolved Oxygen Meter[1]

Daily	As Needed
Daily when used: Calibrate with check standards.	Electronics serviced.

TABLE 8.9-21
Instrument Maintenance Schedule
Conductance Meter[1]

Daily	As Needed
Daily when used: Calibrate with check standards.	Electronics serviced.

TABLE 8.9-22
Instrument Maintenance Schedule
Chemical Oxygen Demand (COD) Reactor

Daily	As Needed
Daily when used: Calibrate with check standards.	Electronics serviced.

TABLE 8.9-23
Instrument Maintenance Schedule
Spectrophotometer[1]

As Needed	Daily	Monthly	Annually
Dust the lamp and front of the front lens.	Check the zero %T adjustment.	Perform wavelength calibration at 530 nm.	Oil bearings.

TABLE 8.9-24
Instrument Maintenance Schedule
pH Meter[1]

As Needed	Daily
Clean electrode.	Verify electrodes are properly connected and filled.
Refill reference electrode.	Make sure electrode is stored in buffer.

TABLE 8.9-25
Instrument Maintenance Schedule
Fourier Transform Infrared Spectrometry (FTIR)[1]

Check desiccant every 3 months.
Check KBr window every 3 months.

TABLE 8.9-26
Instrument Maintenance Schedule
Radiological Analysis Equipment[1]

Instrument	Items Checked/Service	Minimum Frequency
Alpha Proportional	Check gas flow	Daily
	Clean sample tray	Weekly
	Check bubbler oil level	Monthly
Beta Proportional	Check gas flow	Daily
	Clean sample holders	Weekly
Liquid Scintillation	Clean sample changer	Weekly
	Check condensate trays	Weekly
	Check air filters	Monthly
Quad aß Proportional	Check gas flow	Daily
	Clean sample holders	Weekly
Gamma Spectroscopy	Check LN_2 level	Bi-weekly
	Replace plastic liner	Weekly
Alpha Spectroscopy	Clean sample holder	As needed
	Change vacuum pump oil	Every six months
LIPA	Clean sample changer	Weekly
	Check laser dye performance	Weekly
Benzene Synthesizer	Check gas tubes	Weekly
	Clean instrument	Monthly
Electrolytic Enrichment	Check electrical leads	Monthly
	Clean system	Monthly
Fluorometer	Clean sample holder	Weekly

Footnotes to Preventive Maintenance Tables

(1) Refer to manufacturer's instructions for each instrument to perform maintenance operations.
(2) Also see Table C-11 for applicable "As Needed" GC maintenance.

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GLOSSARY

Glossary

acceptance limits

Data quality limits specified for analytical method performance.

accuracy

Accuracy is a measure of the bias inherent in a system or the degree of agreement of a measurement with an accepted reference or true value. It is most frequently expressed as percent recovery. (See percent recovery).

aliquot, aliquant

A measured portion of a sample taken for analysis.

analytical spike

A sample created by spiking target analytes into a prepared portion of a sample just prior to analysis. (Also see matrix spike.)

anomaly

(See nonconformance)

arithmetic mean (Also see mean)

The arithmetic mean ($\bar{x}$) is the average of a set of values. It is equal to the sum of the observed values divided by the number of observations. Also called "average".

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

where: $\bar{x}$ = the mean

x_i = the i^{th} data value

n = number of data values

assessment

The evaluation process used to measure the performance or effectiveness of a system and its elements. Assessment is used as an all-inclusive term to denote any of the following: performance, systems, data and compliance audits, management systems reviews, peer reviews, inspections, or spot assessments.

associate

employee

audit

A planned and documented investigative evaluation of an item or process to determine its adequacy and effectiveness as well as compliance with established procedures, instructions, drawings, QAPPs, QAPjPs, and other applicable documents.

bias

A systematic (consistent) error in test results. Bias is expressed as the difference between the population mean and the true or reference value, or as estimated from sample statistics, the difference between the sample average and the reference value.

blind performance evaluation sample

A sample either submitted to the laboratory or prepared in the laboratory whereby the concentrations of parameters of concern are known by the preparer and not by the laboratory.

calibration

Establishment of a relationship between various calibration standards and the measurements of them obtained by a measurement system, or portions thereof. The levels of the calibration standard should bracket the range of levels at which actual measurements are to be made. Calibration is also the act of making a scheduled comparison of instrument performance against national standards for instruments which measure physical parameters such as mass, time, and temperature. This type of calibration is independent of use in specific analyses and projects.

calibration curve

The graphical relationship between the known values for a series of calibration standards and instrument responses.

calibration factor (CF) (Also see RF and RRF)
The ratio of the instrument response of an analyte to the amount injected. CFs are used in external standard calibrations.

$$CF = \frac{Total\ Area\ of\ Peak}{Mass\ Injected}$$

calibration standard
A standard used to quantitate the relationship between the output of a sensor and a property to be measured. Calibration standards should be traceable to Standard Reference Materials (provided by NIST, EPA, or other recognized standards agencies) or a primary standard.

Certificate of Analysis
The standard Quanterra format for reporting analytical results.

certified reference material
A reference material accompanied by a certificate issued by an organization certifying the contents and concentration(s) of the material. (See also Standard Reference Material.)

Chain-of-Custody
A system of documentation demonstrating the physical custody and traceability of samples.

check standard analyses
A standard (often a midpoint standard) analyzed at a frequency specified in the method or in an SOP to verify the continuing calibration of the standard curve.

client
See customer.

client sample
The material or collection media submitted to the laboratory for analysis. Field QC samples are considered client samples but laboratory QC samples are not counted as client samples when counting samples for batches.

coefficient of variation (relative standard deviation)

A measure of precision (relative dispersion). It is equal to the standard deviation (s) divided by the mean ($\bar{x}$) and multiplied by 100 to give a percentage value.

$$CV\,(RSD) \;=\; \left(\frac{s}{\bar{x}}\right) x\ 100$$

collocated samples

Independent samples collected in such a manner that they are equally representative of the variable(s) of interest at a given point in space and time. The results will indicate sampling as well as analytical variability.

comparability

A measure of the confidence with which one data set can be compared to another.

completeness

The amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal operations. It is usually expressed as a percentage:

$$\%\ Completeness \;=\; \frac{V}{n}\ x\ 100$$

where: V = number of measurements judged valid
n = total number of measurements

composite

A sample composed of two or more increments.

control chart

A graphical representation of analytical accuracy. Displays the arithmetic mean of a data set, the upper and lower warning limits and the upper and lower control limits.

control table

A tabular presentation of test results with respect to time or sequence of measurement, together with limits within which the results are expected to lie when the analytical process is in a state of control.

controlled document

A document for which the distribution is known. Updates of the document are sent to the original recipients, unless the copy distributed is an uncontrolled copy.

corrective action

A measure taken to rectify conditions adverse to quality and, where necessary, to preclude their recurrence.

correlation coefficient

The correlation coefficient (r) is a determination of how closely data "fits" a straight line. It is a number between -1 and 1 that indicates the degree of linear relationship between two sets of numbers. A correlation coefficient of +1 (usually calculated to three decimal places or 1.000) means the data falls exactly on a straight line with positive slope. A correlation coefficient of -1 (or -1.000) means the data falls exactly on a straight line with negative slope.

customer

Any individual or organization for whom items or services are furnished or work is performed in response to defined requirements and expectations; a client.

data quality objective (DQO)

A statement defining the type of data, the manner in which such data may be combined, and the acceptable uncertainty in those data in order to resolve an environmental problem or condition. This may also include the criteria or involving the environment, including but not limited to: characterization of environmental processes and conditions; environmental monitoring; environmental research and development; the design, construction, and operation of engineered environmental systems; and laboratory operations on environmental samples.

data validation (See validation - data)

data verification (See verification - data)

deficiency (See nonconformance)

degrees of freedom

The number of independent deviations used in calculating an estimate of the standard deviation.

double blind performance evaluation sample

A sample that contains select parameters at defined levels. The levels are unknown to the laboratory. The laboratory is also unaware that the sample is a performance evaluation sample.

duplicate sample analyses

Different aliquots of the same sample are analyzed to evaluate the precision of an analysis.

error

The difference between an observed or measured value and its true value.

field blank

A blank that is prepared and handled in the field and analyzed in the same manner as its corresponding client samples.

field matrix spike

A sample created by spiking target analytes into a sample in the field at the point of sample acquisition.

finding

An event discovered during an audit which, if continued, is sufficient to render the quality of an item unacceptable or indeterminate.

geometric mean

The n^{th} root of the product of all values in a set of n values or the antilogarithm of the arithmetic mean of the logarithms of all the values of a set of n values. The geometric mean is generally used when the logarithms of a set of values are nearly normally (Gaussian) distributed, such as is the case of much population data.

initial calibration

Analysis of a series of analytical standards at different specified concentrations; used to define the linearity and dynamic range of the response of an instrument to the target compounds prior to the analysis of samples.

inspection

Examination or measurement of an item or activity to verify conformance to specific requirements.

instrument detection limit (IDL)

The smallest concentration or amount an instrument can reliably detect.

internal standard (IS)

A compound added to every standard, QC sample, client sample or sample extract at a known concentration prior to analysis for the purpose of quantitation. For example, internal standards are used as the basis for quantitation of the target compounds by GC/MS.

linear regression

A statistical method for finding a straight line that best fits a set of two or more data points, thus providing a relationship between two or more variables.

matrix

The component or substrate which contains the analyte(s) of interest. Examples of matrices are water, soil or sediment, and air. Matrix is not synonymous with phase (liquid or solid).

matrix effect

An interference in the measurement of analyte(s) in a sample that is caused by materials in the sample. Matrix effects may cause elevated reporting limits or may prevent the acquisition of acceptable results.

matrix spike (MS)

An aliquot of a matrix fortified (spiked) with known quantities of specific compounds and subjected to an entire analytical procedure in order to indicate the appropriateness of the method for a particular matrix. The percent recovery for the respective compound(s) is then calculated.

matrix spike duplicate (MSD)

A second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

may

Denotes permission but not a requirement.

mean (See arithmetic mean)

measurement

The process or operation of ascertaining the extent, degree, quantity, dimensions, or capability with respect to a standard.

median

The middle value of a set of data when the data set is ranked in increasing or decreasing order.

method

An assemblage of techniques.

method blank

An analytical control consisting of all reagents, which may include internal standards and surrogate standards, that is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background contamination. Examples of method blanks are a volume of deionized or distilled laboratory water for water samples, a purified solid matrix for soil/sediment samples, or a generated zero air.

method detection limit (MDL)

The minimum concentration of an analyte that, in a given matrix and with a specific method, can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is operationally defined as:

$$MDL = st_{(n-1,\ \alpha=0.99)}$$

where s = the standard deviation of a number of measurements of a blind or sample matrix containing the analyte at a concentration near the lowest standard recommended in the method and

$t_{(n-1, \alpha=0.99)}$= the student's value for a one-sided t-statistic appropriate for the number of samples used to determine (s), at the 99% confidence level and n-1 degrees of freedom.

modified method

A standard or reference method which has been changed to meet project or matrix requirements.

must

Denotes a requirement is mandatory and has to be met.

nonconformance

An unplanned deviation from an established protocol or plan. The deviation may be the result of Quanterra's actions, then termed a deficiency. If the deviation is the result of events beyond the control of Quanterra, it is termed an anomaly.

operational calibration

Routinely performed as part of instrument usage, such as the development of a standard calibration curve. Operational calibration is generally performed for instrument systems.

outlier

A result excluded from the statistical calculations due to being deemed "suspicious" when applying the "Grubbs Test" (or equivalent).

parameter

A constant or coefficient that describes some characteristic of a population (e.g., standard deviation, mean, regression coefficients). Also, a chemical being measured, i.e., an analyte.

percent difference

When two independent measurements of the same characteristics are available, it is possible to use the percent difference instead of the coefficient of variation to measure precision.

$$\%D = \left| \frac{X_1 - X_2}{X_1} \right| x\ 100\%$$

where: %D = percent difference

X_1 = first value

X_2 = second value

percent recovery

A measure of accuracy determined from the comparison of a reported spike value to its true spike concentration.

$$\%R = \frac{observed\ conc.\ -\ sample\ conc.}{true\ spike\ conc.}\ x\ 100\%$$

performance audit (See performance evaluation)

performance evaluation

A type of audit in which a known or characterized value is compared to the result obtained through the routine analysis of the sample in the laboratory to evaluate the proficiency of an analyst or laboratory.

periodic calibration

A calibration that is performed at prescribed intervals for equipment such as balances, thermometers, and balance weights. In general, they are performed on equipment that are distinct, singular purpose units, and are relatively stable in performance.

population

A generic term denoting any finite or infinite collection of individual things, objects, or events.

practical quantitation limit (PQL)

The lowest concentration a method can reliably achieve within limits of precision and accuracy and is derived from empirical, matrix-free method performance studies.

precision
A measurement of mutual agreement (or variability) among individual measurements of the same property, usually under prescribed similar conditions. Precision is usually expressed in terms of relative standard deviation or relative percent difference, but can be expressed in terms of the variance, range, or other statistic.

preventive maintenance
An organized program, within Quanterra laboratories, of actions (such as equipment cleaning, lubricating, reconditioning, adjustment and/or testing) taken to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use.

primary standard
A material having a known, stable property that can be accurately measured or derived from established physical or chemical constants. It is readily reproducible and can be accepted (within stated limits) and used to establish the same value of another substance or item.

procedure
Detailed instructions to permit replication of a method. (See standard operating procedure.)

proficiency testing
Special series of planned tests which will determine the ability of field technicians or laboratory analysts to perform routine analyses. The results from this testing may be used for comparison against established criteria or for relative comparisons among the data from a group of technicians or analysts.

project-specific reporting limit (PSRL)
(See reporting limit)

protocol
Methodology specified in regulatory, authoritative, or contractual situations.

QC batch
A set of up to 20 field samples that behave similarly (i.e., same matrix) and are processed using the same procedures, reagents, and standards within the same time period.

QC check sample
A reference matrix containing known concentrations of parameters of interest. If prepared in the laboratory, it is made using stock standard solutions independent of those used for calibration. If the results of these parameters do not meet acceptance criteria, corrective actions are taken.

qualification (personal)
The characteristics of abilities gained through education, training, or experience, as measured against established requirements, such as standards or tests, that qualify an individual to perform a required function.

quality
The sum of features and properties/characteristics of a process, item, or service that bears on its ability to meet the stated needs of the user. Quanterra has defined quality as meeting the needs of our clients, both internal and external.

quality assurance
An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality Assurance Management Plan
The Quality Assurance Management Plan for Environmental Analyses (QAMP) is a formal document that provides additional, more specific guidance to the QMP. The QAMP is focused more closely on environmental analyses than the QMP, which addresses company-wide analytical and non-analytical quality systems.

Quality Assurance Project Plan (QAPjP)
An orderly assembly of detailed and specific procedures by which an agency or laboratory delineates how it produces quality data for a specific project or measurement method.

quality control
The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer or by Quanterra.

quality improvement
A management program for improving the quality of operations. Such programs generally entail a formal mechanism for encouraging worker recommendations with timely management evaluation and feedback or implementation.

quality management
That aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality system.

quality management plan
A formal document that describes the quality system in terms of the organizational structure, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, and assessing all activities conducted. When capitalized (as in QMP), the acronym refers to the Quanterra Quality Management Plan.

quality management system
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, and implementation plan of an organization for ensuring quality in its work processes, products, and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. When capitalized (as in QMS), the acronym refers to the Quanterra Quality Management System.

random error
Variations of repeated measurements that are random in nature and individually not predictable.

range
The difference between the largest and smallest numbers in a set of numbers.

raw data
All documentation associated with the original recording of analytical results pertinent to a specific sample or set of samples. This may include laboratory worksheets, calculation forms, instrument-generated output, analyst notes, etc., from sample receipt through final reporting.

readiness review

A systematic, documented review of the readiness for the start-up or continued use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond project milestones and prior to initiation of a major phase of work.

reagent water

Water in which an interferant is not observed at or above the minimum quantitation limit of the parameters of interest. The reagent water's purity and acceptability is verified by analysis with each set of samples.

recovery

(See percent recovery)

reference method

A method of known and demonstrated accuracy.

regression coefficients

The quantities describing the slope and intercept of a regression line.

relative error

An error expressed as a percentage of the true value or accepted reference value.

relative percent different (RPD)

Statistic for evaluating the precision of a replicate set. For replicate results x_1 and x_2:

relative response factor (RRF) (See also CF and RF)

A measure of the relative mass spectral response of a compound compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples. Because a RRF is the comparison of two responses, it is a unitless number. RRFs are determined by the following equation:

$$RRF = \frac{A_x}{A_{IS}} x \frac{C_{IS}}{C_x}$$

where: A = area of the characteristic ion measured
C = concentration
IS = internal standard
x = analyte of interest

relative standard deviation
See coefficient of variation.

reporting limit
One of two types of reporting limit conventions within Quanterra. The Standard Reporting Limit (SRL) is a uniform, Quanterra-wide reporting limit based on an evaluation of the PQLs at Quanterra laboratories and the expected method performance in routine water and soil matrices. Project Specific Reporting Limits (PSRLs) are reporting limits that are defined by project requirements.

representative sample
A sample taken to represent a lot or population as accurately and precisely as possible.

representativeness
The degree to which a sample or group of samples is indicative of the population being studied.

reproducibility
The precision, usually expressed as a standard deviation, measuring the variability among results of measurements of the same sample at different laboratories.

response factor (RF) (Also see CF and RRF)
A factor derived from the calibration of a compound that is used in the quantitation calculation of sample analytes. A response factor may be derived from an external standard calibration (then called a Calibration Factor) or from an internal standard calibration (then called a Relative Response Factor).

secondary standard
A material having a property that is calibrated against a primary standard.

self assessment
Assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing or performing the work.

shall

Denotes a requirement that is mandatory and has to be met.

should

Denotes a guideline or recommendation.

standard addition

The procedure of adding known increments of the analyte of interest to a sample to cause increases in detection response to subsequently establish by extrapolation of the plotted responses the level of the analyte of interest present in the original sample.

standard deviation

A measure of the dispersion about the mean of the elements in a population. The square root of the variance of a set of values:

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n-1}}$$

where: s = standard deviation
Σ = sum of
X = observed values
n = number of observations

standardization

The establishment of the value of a potential standard with respect to an established or known standard.

standard method

A method of known and demonstrated precision issued by an organization generally recognized as competent to do so.

standard operating procedure

A written document that details an operation, analysis, or action, with prescribed techniques and steps, that is officially approved as the method for performing certain routine or repetitive tasks.

standard reference material

A material produced in quantity, of which certain properties have been certified by the National Institute of Standards and Technology (NIST), formerly NBS, or other agencies to the extent possible to satisfy its intended use.

standard reporting limit

See reporting limit.

statistic

A constant or coefficient that describes some characteristic of a sample. Statistics are used to estimate parameters of populations.

stock solution

A concentrated solution of analyte(s) or reagent(s) prepared and verified by prescribed procedure(s), and used for preparing working standards or standard solutions.

subsample

A portion taken from a sample. A laboratory sample may be a subsample of a gross sample; similarly, a test portion may be a subsample of a laboratory sample.

surrogate (surrogate standard)

Compounds, when required by a method, that are used added to every blank, sample, LCS, matrix spike, matrix spike duplicate, and standard. They are used to evaluate analytical efficiency by measuring recovery. Surrogates include brominated, fluorinated, or isotopically labeled compounds that are not expected to be detected in environmental media.

supplier

Any individual or organization furnishing items or services or performing work according to a procurement document. This is an all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, or consultant.

systems audit

A systematic on-site qualitative review of facilities, equipment, training, procedures, recordkeeping, data verification, and reporting aspects of a quality assurance system to arrive at a measure of the capability of the system. Within Quanterra, system audits are performed on a periodic basis under the direction of the Quanterra Director, QA.

systematic error

The condition of a consistent deviation of the results of a measurement process from the reference or known level.

technique

Physical or chemical principle for characterizing materials of chemical systems.

traceability of data

The entire documented chain of acquired data from the original acquisition effort through to the final tabulation, synthesis, reduction, and storage activities. The documentation will allow complete reconstruction of the data.

traceability of samples

During all environmental monitoring field efforts, acquired samples will be assigned specific and unique identification numbers. These sample numbers shall be accompanied by documentation (chain-of-custody form) which clearly identifies all parameters associated with sample acquisition. All additional sample numbering systems applied to the sample must be clearly cross-referenced to the field sample number to provide for traceability of samples from acquisition to reporting of sample results.

traceability of standards

The ability of an analytical standard material used for calibration purposes to be traced to its source. The standards used by Quanterra must be traceable via written documentation to sources which produce or sell verified or certified standards, i.e., National Institute for Standards and Technology, USEPA, or vendors preparing standards from those sources which they have certified.

validation - computer software

The process of establishing documented evidence which provides a high degree of assurance that software will consistently produce a product meeting its predetermined specifications and quality attributes. This process demonstrates that the mathematical or statistical model embodied in the computer program is an acceptable representation of the process for which it is intended and meets all specified requirements.

validation - data

The process of a second party performing a systematic review of the raw and final data produced by a laboratory using predetermined criteria to ascertain the validity of the data with respect to the criteria (e.g., HAZWRAP data validation).

vendor
See supplier.

verification - computer software
The process of comparing software performance against known results to ensure that it correctly performs its intended function.

verification - data
The process of reviewing data to ensure that data reduction has been correctly performed and that analytical results to be reported correspond to the data acquired and processed.

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APPENDIX A

Appendix A

Quality Assurance Management Plan
Quanterra Incorporated

Non-Operations
Organization Charts

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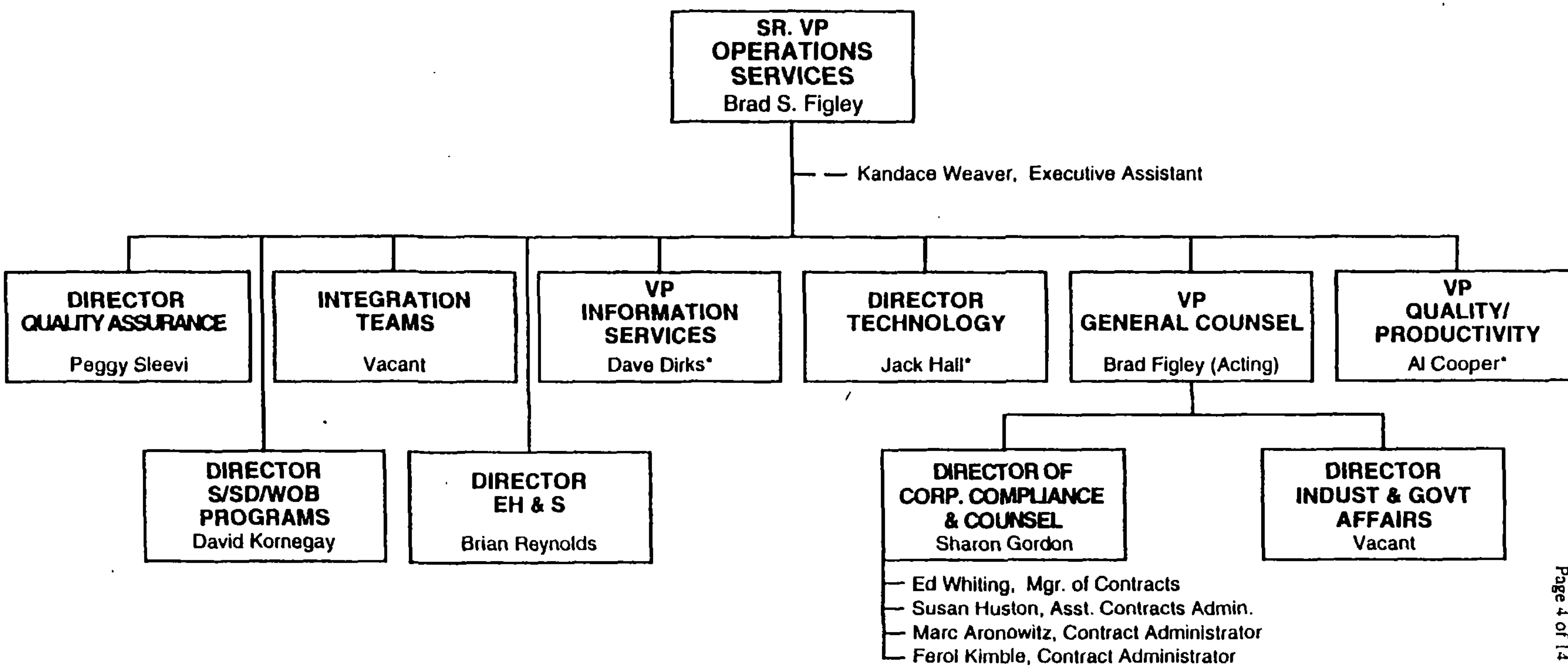
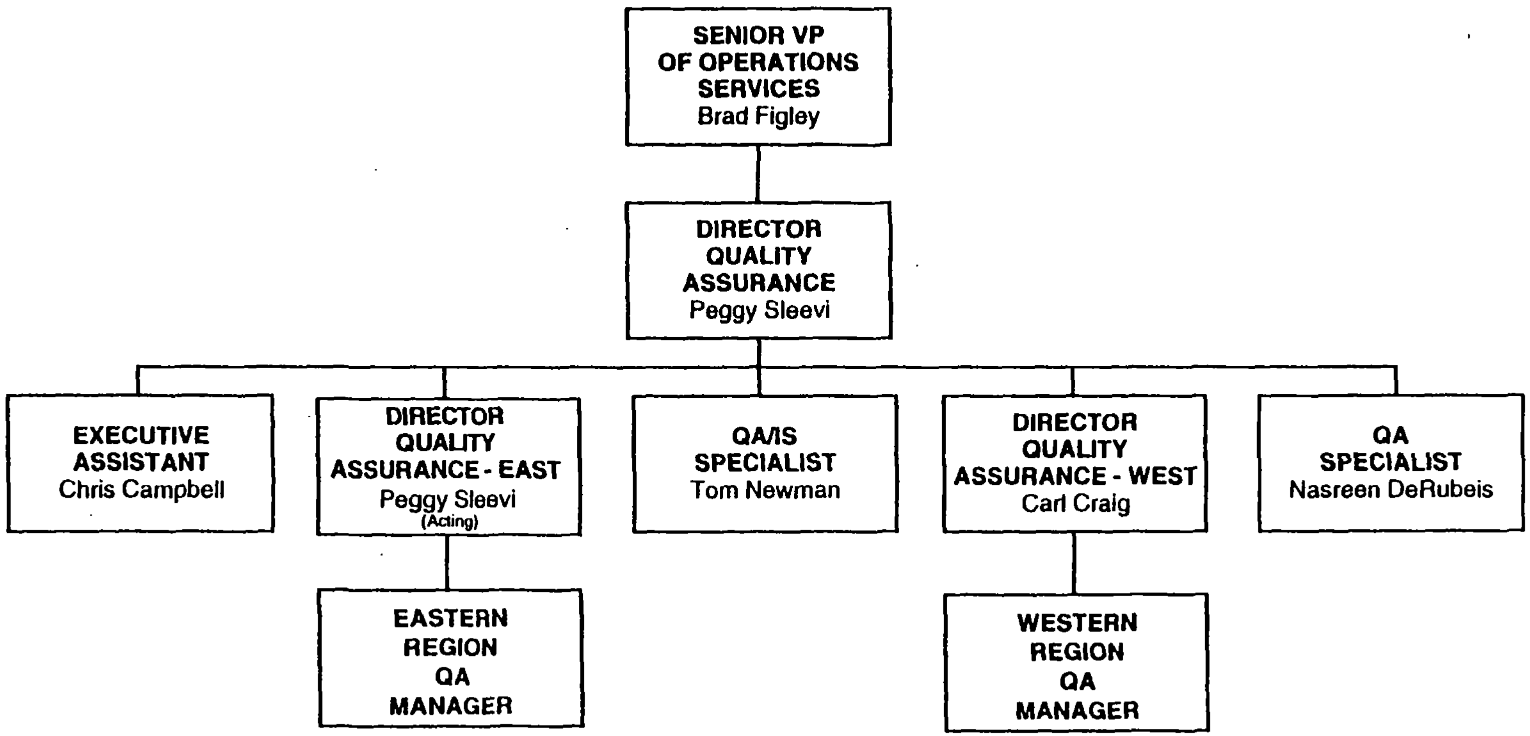
Quanterra
Key Personnel - Corporate

Associate Name	Title	Degree	Years Experience
James G. Kaiser	President and CEO	MS, Management	27
William McCowan	VP, Finance and Administration	MBA, Finance	22
Linda Guillory	VP, Human Resources	BA, Psychology	25
Ernie Hurtado	Director, Purchasing	BS, Accounting	25
R. James Bentley	VP and General Manager, Federal Systems	BS, Chemistry	15
Michael J. Miille	VP and General Manager, Commercial Markets and Advanced Technology	PhD, Environmental Chemistry	15
Robert E. George	VP and General Manager, Laboratory Operations-East	MS, Environmental Engineering	24
Donnie Heinrich	VP and General Manager, Laboratory Operations-West	BS, Chemistry	20
Brad S. Figley	Senior VP, Operations Services	JD in Law	14
Albert C. Cooper	VP, Quality and Productivity	BS, Business Management	19
David Dirks	VP, Information Services	BS, Manufacturing and Industrial Engineering	16
Sharon Gordon	Corporate Counsel and Director, Contract Compliance	MA, Urban and Environmental Planning JD in Law	15
Brian Reynolds	Director, Environmental Health and Safety	PhD., Organic Chemistry CIH 1987	22
Jack Hall	Director, Technology	BS, Chemistry	31
Margaret S. Sleevi	Director, Quality Assurance	MS, Chemistry	16
Carl Craig	Director, Quality Assurance-West	PhD, Chemistry	7

QUANTERRA INCORPORATED
OPERATIONS SERVICES



QUANTERRA INCORPORATED
QUALITY ASSURANCE



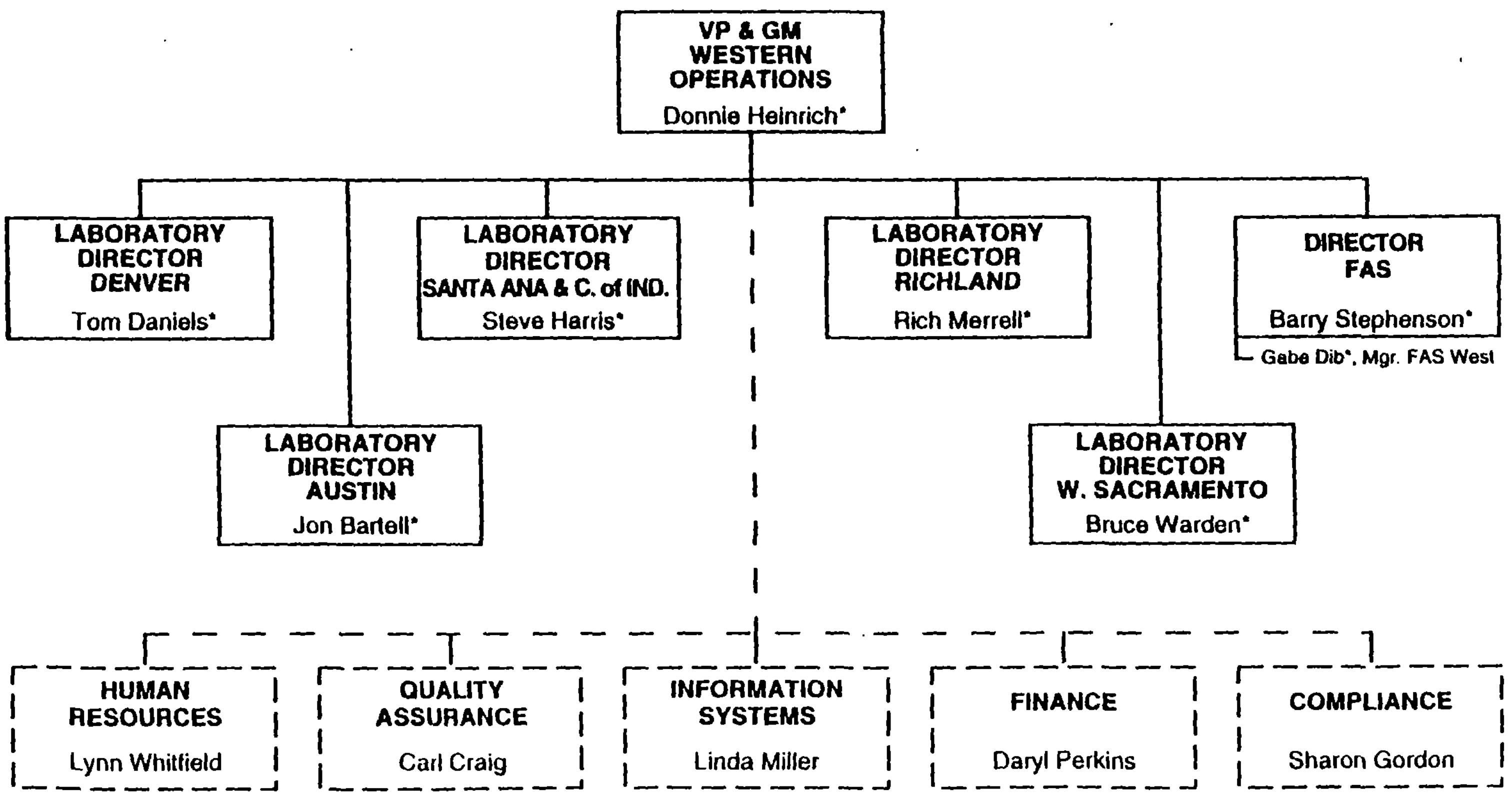
QUANTERRA INCORPORATED
EASTERN REGION OPERATIONS

VP GM EASTERN OPERATIONS
Bob George*

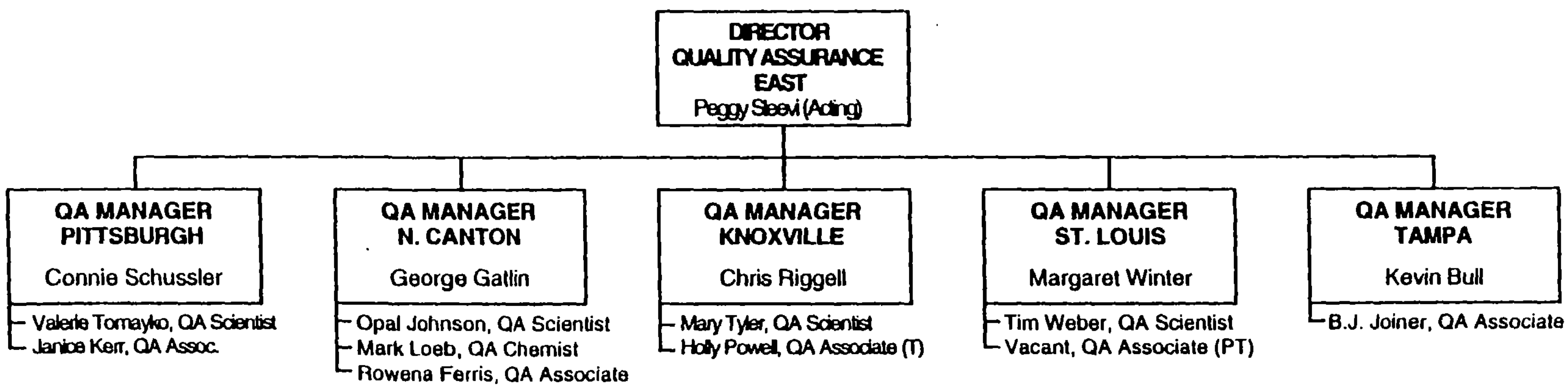
Theresa Kemper, Admin. Asst.

- **NORTH CANTON LAB DIRECTOR**
  Bob George*
  (acting)
- **KNOXVILLE LAB DIRECTOR**
  Bruce Wagner*
- **TAMPA LAB DIRECTOR**
  Randy Grubbs*
- **PITTSBURGH LAB DIRECTOR**
  John Flaherty*
- **ST. LOUIS LAB DIRECTOR**
  Larry Taake*

QUANTERRA INCORPORATED
WESTERN REGION OPERATONS



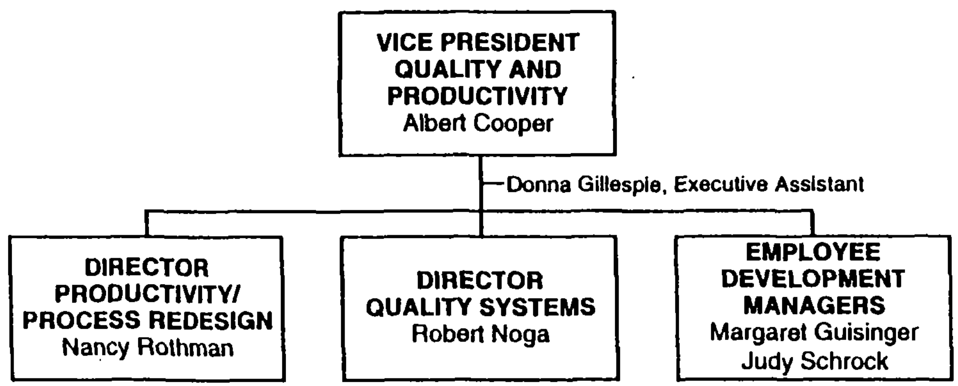
QUANTERRA INCORPORATED
EASTERN QUALITY ASSURANCE



QUANTERRA INCORPORATED
WESTERN QA

- **DIRECTOR QUALITY ASSURANCE WEST** – Carl Craig
  - **QA MANAGER SANTA ANNA** – Scott Hoatson
    - Lee Roudybush, QA Scientist
    - Bob Sundberg, QA Chemist (TR)
  - **QA MANAGER WEST SACRAMENTO** – Gail Celaschi
    - Rose Harrelson, QA Chemist
    - John Swanson, QA Chemist
  - **QA MANAGER AUSTIN** – Alice Wusterhausen
    - Bonnie Young, QA Chemist
  - **QA MANAGER DENVER** – Larry Pennfold
    - Tim Miller, QA Scientist
    - Bill Sullivan, QA Chemist
    - Jim Stoner, QA Assoc. (T)
  - **QA MANAGER RICHLAND** – Doug Swenson
    - Cindy Black, QA Scientist
    - Bev Giroir, QA Chemist
    - Rhonda Wager, QA Assoc.
  - **QA MANAGER ALASKA** – Vacant
  - **QA MANAGER FIELD ANALYTICAL SERVICES** – Emanuel Hignutt (P/T)*

QUANTERRA INCORPORATED
QUALITY AND PRODUCTIVITY

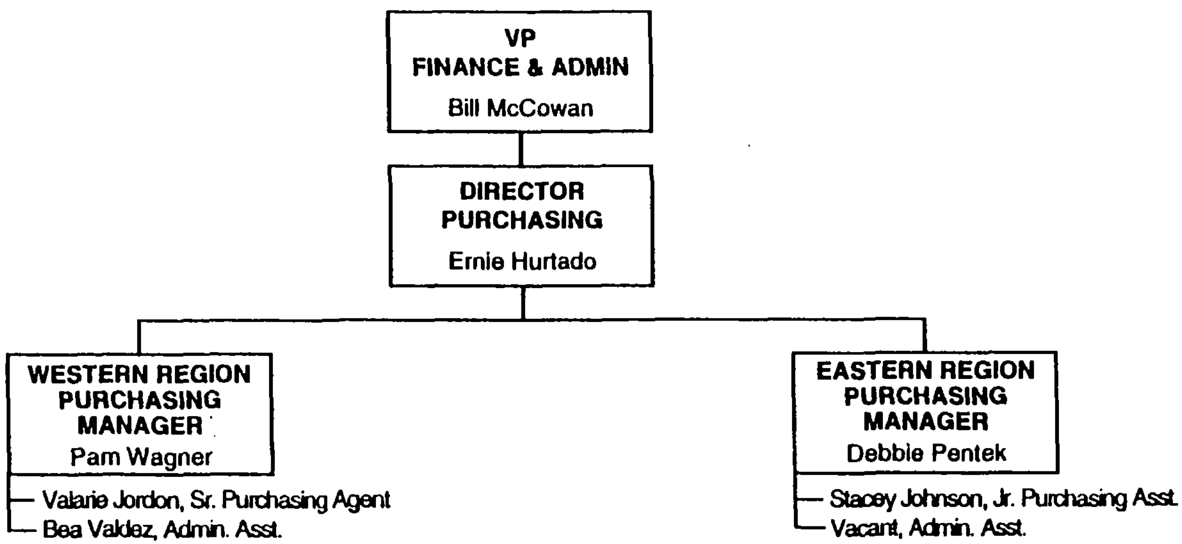


QUANTERRA INCORPORATED
QUALITY ASSURANCE, ENVIRONMENTAL HEALTH & SAFETY, & TECHNOLOGY

SR VP OPERATIONS SERVICES
Brad Figley

- **DIRECTOR QUALITY ASSURANCE** — Peggy Sleevi
  - Chris Campbell, Exec. Asst.
  - Nasreen DeRubeis, QA Specialist
  - Tom Newman, QA/IS Specialist
  - **DIR. QA WEST** — Carl Craig
    - Scott Hoatson, QA Mgr., Santa Ana
    - Gail Celaschi, QA Mgr., Sacramento
    - Alice Wusterhausen, QA Mgr., Austin
    - Vacant, QA Mgr., Alaska
    - Douglas Swenson, QA Mgr., Richland
    - Emmanuel Hignutt, QA Mgr., FAS
    - Larry Penfold, QA Mgr., Denver
  - **DIR. QA EAST** — Peggy Sleevi (Acting)
    - Connie Schussler, QA. Mgr. Pittsburgh
    - George Gatlin, QA. Mgr. N. Canton
    - Chris Rigell, QA. Mgr. Knoxville
    - Margaret Winter, QA. Mgr. St. Louis
    - Kevin Bull, QA. Mgr. Tampa
- **DIRECTOR TECHNOLOGY** — Jack Hall
  - Karen Mann, Sr Admin. Asst.
  - Deb White, Principal Scientist, Inorganics
  - Richard Burrows, Principal Scientist, Organics
  - Kurt Ill, Technology Manager, Wet Chem
  - Mark Bruce, Technology Manager, Prep
  - **SPECIAL ASSIGNMENTS TECHNOLOGY PROJECTS**
    - Robyn Wagner, Principal Scientist
- **DIRECTOR EH&S** — Brian Reynolds
  - Joan Kapraly, EH&S Coordinator

QUANTERRA INCORPORATED
PURCHASING



QUANTERRA INCORPORATED
FEDERAL SYSTEMS

- **VICE PRESIDENT AND GENERAL MANAGER** — Jim Bentley
  - Sharle Henrich, Executive Assistant
  - **DIRECTOR OF FEDERAL CUSTOMER SERVICE** — Maureen McDevitt
    - Cheryl Ferguson, Cust. Svc. Mgr., S. CA
    - Diane Lowry, Cust. Svc. Mgr., Denver
    - Denise McDonald, Cust. Svc. Mgr., Austin
    - Ben Landas, Cust. Svc. Mgr., Pittsburgh
    - Jackie Waddell, Cust. Svc. Mgr., Knoxville
    - Marla Fastenau, Cust. Svc. Mgr., St. Louis
    - Kendra DeSantolo, Cust. Svc. Mgr., Sacramento
    - Nilo Ligi, Cust. Svc. Mgr., Sacramento
    - Pete Wells, Cust. Svc. Mgr., Rocky Flats
    - Bob Hanisch, Cust. Svc. Mgr., Denver
  - **KEY ACCOUNTS MANAGER** — Norm Flynn
  - **DIRECTOR OF PROPOSALS** — Ed Fuller
    - Stacy Aubuchon, Prop. Coor., St. Louis
    - Jessica Boyd, Prop. Coor., Knoxville
    - Jeff Hatala, Prop. Coor., Pittsburgh
    - Julia Wilcox, Prop. Coor., Sacramento (PT)
  - **DIRECTOR OF BUSINESS DEVELOPMENT - DOE** — Joe Pellegrino
    - Mike Paessun, Natl. Acct. Mgr.
  - **FEDERAL INFORMATION SYSTEMS** — Susan Dakuzaku
    - B. Jordan
    - J. Lee
    - R. Fox
  - **FEDERAL SYSTEMS CONTROLLER** — Lydia Coleondro

QUANTERRA INCORPORATED
INFORMATION SERVICES

- **VP INFORMATION SYSTEMS** — David Dirks
  - Carla Drew, Admin. Asst.
  - **DIRECTOR CORPORATE IS** — Mark Goedde
    - **CHANGE MGMT/ TRAINING & HELP DESK**
      - Jackie Olson, Training Specialist
      - Sarah Braxter, Help Desk Coord.
    - **MGR - CORP. SYS.** — *Colleen Davis*
      - **Finan/Purchasing**
        - Steve Kuykendall, Sr. Pgmr Analyst
        - Open, Pgmr Analyst
      - **HR/Payroll**
        - Open, Pgmr Analyst
      - **Devel/Maintenance**
        - Renee Fye, Pgmr Analyst
        - Alan Schneider, Pgmr Analyst
        - Open, Sr. Pgmr Analyst
        - Open, Sr. Pgmr Analyst
    - **TECHNICAL LEADERSHIP** — Scott Greene
      - Tom MacClanahan, Automation Spclst.
      - Al Bowen, Sr. Prog/Analyst
      - Bill Botimer, Automation Spclst.
    - **MGR - TECH SERVICES** — Chuck Yoke
      - **Telecommunications**
        - Rick Lowe, Telecom Analyst
        - Lynn Cooper, Telecom Analyst
      - **Technical Specialist**
        - Open, Sr Sys. Pgmr.
        - Erik Olsen, VAX System Mgr.
      - **Office Automation**
        - Charles Eversole, Technical Leadership
        - Max Allen, Office Automation App. Analyst
        - Ray Appel, Office Automation App. Analyst
      - **Computer Operations**
        - Jeff Balash, Lead Comp Operator (CO)
    - **ADV. TECH. GRP.**
      - Jim Darr, Sr. Tech. Specialist
  - **DIRECTOR BUSINESS SUPPORT SERVICES** — David Poundstone
    - Walter Berger, Dir. QA Support
    - Brandy Jordan, Client Services (SAC)
    - Joe Lee, Client Services (SAC)
    - Vacant, Client Services (TN)
    - Roberta Fox, Client Services (GG)
    - Julie Jones, Client Services (TX)
    - Susan Dakuzaku, Dir. Federal Support
    - Dan Golden, Client Services (CO)
    - Marla Savanovich, Client Services (OH)
    - John Feir, Client Services (CO)
    - Ted McElroy, Client Services (TN)
    - Tracy Laferty, Client Services (CO)
  - **DIRECTOR EAST - LAB IS** — Mike Sekel
    - **LIMS/UserServices**
      - Open, (OH) User Services Analyst
      - Lou Beckert, (PA) User Services Analyst
      - Joyce Gerthoffer, (PA) User Services Analyst
      - Jim York, (MO) User Services Analyst
      - Janice Sterrett, (TN) User Services Analyst
    - **LAN Analysis**
      - Open, (PA) LAN App Support Analyst
      - Pete Flohr (OH) LAN App Support Analyst
      - Kelly Ramey, (MO) LAN App Support Analyst
      - Mike Sara, (FL) LAN App Support Analyst
      - Buddy Robinson, (TN) LAN App Support Analyst
  - **DIRECTOR WEST - LAB IS** — Linda Volleberg
    - **LIMS/UserServices**
      - Mary Young, (TX) User Services Analyst
      - Ken Miller, (WA) User Services Analyst
      - Jean Fielding, (Santa Ana) User Services Analyst
      - Cindy Patterson, (CO) User Services Analyst
      - Ayla Douglas (SAC) User Services Analyst
      - Open, (AK) User Services Analyst
      - Jolene Cooper, (City of Ind.) User Services Analyst
    - **LAN Analysis**
      - Jefferson Jih, (Santa Ana) LAN App Support Analyst
      - Mark Lund (SAC), LAN App Support Analyst
      - Jack Daniels, (TX) LAN App Support Analyst
      - Scott Wolfe, (CO) LAN App Support Analyst
      - Bob Loeber, (WA) LAN App Support Analyst

APPENDIX B

Appendix B

Quality Assurance Management Plan
Quanterra Incorporated

Facility-Specific Appendix

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List of Laboratory Locations

This appendix contains facility-specific, quality-related information and requirements for Quanterra laboratories. These laboratories are located in the following cities:

- Anchorage, Alaska
- Austin, Texas
- City of Industry, California
- Denver, Colorado
- Knoxville, Tennessee
- North Canton, Ohio
- Pittsburgh, Pennsylvania
- Richland, Washington
- Sacramento, California
- Santa Ana, California
- St. Louis, Missouri
- Tampa, Florida

Each laboratory section in this appendix contains information specific to that laboratory only and contains the following basic outline:

Section	Contents
0	Table of Contents
1	Organizational Chart
2	Instrument List
3	Standard Operating Procedures List
4	Analytical Methods
5	MDLs, RLs, and CRDLs
6	Performance Evaluation Studies
7	Additional Operation-Specific Information

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APPENDIX C

Appendix C

Quality Assurance Management Plan
Quanterra Incorporated

Addresses of Quanterra Locations

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APPENDIX C

ADDRESSES OF QUANTERRA LOCATIONS

LABORATORIES

Alaska
Quanterra
5761 Silverado Way
Suite N
Anchorage, Alaska 99518
Voice: (907) 563-4800
Fax: (907) 563-4815

California
Quanterra
18501 East Gale Avenue
Suite 130
City of Industry, California 91748
Voice: (818) 965-1006
Fax: (818) 965-1003

Quanterra
1721 South Grand Avenue
Santa Ana, California 92705
Voice: (714) 258-8610
Fax: (714) 258-0921

Quanterra
880 Riverside Parkway
West Sacramento, California 95605
Voice: (916) 373-5600
Fax: (916) 372-1059

Colorado
Quanterra
4955 Yarrow Street
Arvada, Colorado 80002
Voice: (303) 421-6611
Fax: (303) 431-7171

Florida
Quanterra
5910 H Breckenridge Parkway
Tampa, Florida 33610
Voice: (813) 621-0784
Fax: (813) 623-6021

Missouri
Quanterra
13715 Rider Trail North
Earth City, Missouri 63045
Voice: (314) 298-8566
Fax: (314) 298-8757

Ohio
Quanterra
4101 Shuffel Drive, N.W.
North Canton, Ohio 44720
Voice: (216) 497-9396
Fax: (216) 497-0772

Pennsylvania
Quanterra
450 William Pitt Way
Building 6
Pittsburgh, Pennsylvania 15238
Voice: (412) 826-5477
Fax: (412) 826-5571

Tennessee
Quanterra
5815 Middlebrook Pike
Knoxville, Tennessee 37921
Voice: (615) 588-6401
Fax: (615) 584-4315

LABORATORIES

Texas
Quanterra
5307 Industrial Oaks Boulevard
Suite 160
Austin, Texas 78735
Voice: (512) 892-6684
Fax: (512) 892-6652

Washington
Quanterra
2800 George Washington Way
Richland, Washington 99352
Voice: (509) 375-3131
Fax: (509) 375-5590

FIELD ANALYTICAL SERVICES

California
Quanterra
4070 Nelson Avenue
Suite A
Concord, California 94520
Voice: (510) 676-6300
Fax: (510) 676-0436

Tennessee
Quanterra
9000 Executive Park Drive
Suite A-110
Knoxville, Tennessee 37923
Voice: (615) 470-3620
Fax: (615) 693-2348

EASTERN REGION CUSTOMER SERVICE CENTER

Quanterra
2200 Cottontail Lane
Somerset, New Jersey 08875
Voice: (908) 469-5800
Fax: (908) 469-7516

INFORMATION SERVICES

Quanterra
9030 Yukon Street
Suite 1000
Westminster, Colorado 80021
Voice: (303) 421-4226
Fax: (303) 420-6029

CORPORATE HEADQUARTERS

Quanterra
One DTC
5251 DTC Parkway
Suite 415
Englewood, Colorado 80111
Voice: (303) 796-2222
Fax: (303) 796-2002

QUALITY ASSURANCE MANAGEMENT PLAN
NORTH CANYON LABORATORY

Facility Appendix

Quality Assurance Management Plan
Quanterra Incorporated

North Canton Laboratory

Approved by:

George Gatlin, Jr.
Quality Assurance Manager
North Canton Laboratory

Margaret S. Sleevi
Director, Quality Assurance
East

Robert E. George
Laboratory Director
North Canton Laboratory

Controlled Copy Number: ____________________

Facility Appendix
North Canton Laboratory

Section North Canton-0

Table of Contents,
North Canton Laboratory

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List of Sections

List of Figures

List of Tables

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Facility Appendix
North Canton Laboratory

Section North Canton-1

Organizational
Chart

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QUANTERRA - NORTH CANTON

LABORATORY DIRECTOR
Bob George (Acting)

- Linda Geis, Exec Asst

PROJECT MANAGEMENT — Deb Hula

- Project Management
  - Alesia Danford, PM
  - Karen Groff, PM
  - Tom Himes, PM
  - Carol Kralik, PM
  - Denise Pohl, PM
  - Brian Smith, PM
  - Jeff Smith, PM
  - Becki Strait, PM
  - Dan Wright, PM
- Project Administrators
  - Ari Blakeman, Recept
  - Pat Blim, PA
  - Michele Daley, PA
  - Theresa Finley, PA
  - Patty McClain, PA
  - Amy McCormick, PA
  - Laura Miller, PA
  - Karen Wagner, PA
  - Kae Yoder, PA

ENV. HEALTH & SAFETY — Shawn Ritts

- Paul Altier, Security Guard
- Ralph Byrd, Tech

RECORDS MANAGEMENT — Anita Castora

- Amy King, Tech

OPERATIONS MANAGER — Chris Oprandi

- Mark Bruce, Organic Tech Advisor
- Kristine Crock, Inorg Tech Advisor
- Brian Greenwell, Prod Improve Mgr
- Jeff Guller, Systems Admin

- Extractions
  - Ray Risden, GL
    - Velma Carr, Analyst
    - Dave Counts, Analyst
    - Kelly Evans, Analyst
    - Tom Fausnight, Analyst
    - John Foland, Analyst
    - Lou Mancine, Analyst
    - Robyn Quarles, Analyst
    - Steve Sablar, Analyst
    - Troy Saffle, Analyst
    - Denise Smail, Analyst
    - Dee Winegardner, Analyst
    - OPEN
- MS Semivolatiles
  - Tom Hula, GL
    - John Gruber, Data Rev
    - Jim Horton, Analyst
    - Angel Siegfried, Data Rev
    - Tammy Tokos, Data Rev
    - Mark Ulman, Analyst
    - Marlene Campbell, Data Rev (P)
- GC Semivolatiles
  - Brad Belding, GL
    - Leona Alberts, Analyst
    - Norma Basko, Analyst
    - Julie Beck, Analyst
    - Todd Benenati, Analyst
    - Lisa David, Analyst
    - Kim Davis, Data Rev
    - Sue Dempster, Data Rev
    - Phil Greene, Analyst
    - Steve Jackson, Analyst
    - Doug Joy, Analyst
    - Rhonda Kuster, Analyst
    - Dorothy Leeson, Analyst
    - Ruby Saurer, Data Rev
    - Paul Sharkey, Analyst
    - Renee Greene, Analyst (P)
    - Carolynne Roach, Analyst (P)
    - Carolyn Van Doren, Analyst (P)
- MS Volatiles
  - Tom Stiller, GL
    - Sherry Arman, Data Rev
    - Laura Evans, Analyst
    - Barb Fausnight, Data Rev
    - Dave Heakin, Analyst
    - Sue Kardohely, Analyst
    - Tim Lavey, Analyst
    - Brad Waybright, Analyst
    - Renee Aubrey, Data Rev (P)
    - Rick Quayle, Analyst (P)
- GC Volatiles
  - Mike Horvath, GL
    - Maureen Hartman, Analyst
    - Chuck Jacobs, Analyst
    - Jim Kapraly, Analyst
    - Jen McCrory, Analyst
    - Duke Stark, Analyst
    - Deb Neal, Analyst (P)
    - Katie Ritts, Analyst (P)
- Shipping
  - Al Haldet, Supervisor
    - Rick Danford, Tech
    - Greg Newman, Tech
    - Chad Owen, Tech
    - Karl Roth, Tech
    - Phil Schumacher, Tech
- Sample Control
  - Lois Ezzo, GL
    - Kris Brooks, Tech
    - Sue Goodin, Tech
    - Kathy Graves, Tech
    - Lisa Haueter, Tech
    - Doris Herren, Tech
    - Tami Stephens, Tech
- Maintenance
  - Brian Haueter, Sup
    - Brian Mitchell, Main
    - Dan Settimio, Cust
- Analytical Services
  - Phyllis Conley**
  - Denise Crison**
  - Edward Bruner, (P)
- Metals
  - Susan Palmer, GL
    - Melissa Balt, Analyst
    - Karen Counts, Analyst
    - Al DiPofi, Analyst
    - Nancy Floom, Tech
    - Heather Geiger, Analyst
    - Kande Greene, Analyst
    - Dave Hurst, Analyst
    - Don Kierstead, Analyst
    - Lisa McGall, Data Rev
    - Pat O'Meara, Analyst
    - Melissa Recznik, Analyst
    - Brenda Repasky, Analyst
    - Roger Toth, Analyst
    - Leslie VanKuren, Analyst
    - Larry Williams, Analyst
- General Chemistry
  - Joanne Hancock, GL
    - Liz Belvin, Analyst
    - Rachelle Belvin, Analyst
    - Dave Cox, Analyst
    - Tim Gregory, Analyst
    - Bruce Hart, Analyst
    - Eric Hewitt, Analyst
    - Julie Kuhle, Analyst
    - Paulette Otto, Analyst
    - Rich Rhodes, Analyst
    - OPEN

QUALITY ASSURANCE* — George Gatlin

- Rowena Farris, Associate
- Opal Johnson, Scientist
- Mark Loeb, Chemist

CUSTOMER SERVICE MANAGER — Jay Bernarding

- FAS — Duane Nielsen
  - Will Cordell, Tech
  - Joe Grant, Tech
  - Eric Miller, Tech

Full-Time Employees	124
Hourly Employees (P)	9 (= 4 FTEs)
Temporary Employees (T)	12
TOTAL	145

GL - Group Leader
Data Rev - Data Reviewer

*QA is included in North Canton headcount, but reports to Corporate.
**On loan to Corporate IS, not in headcount

July 10, 1995

TABLE 1-1
NORTH CANTON LABORATORY
Key Personel Roster

Name	Position	Education	Experience
Robert E. George	Laboratory Director, Interim	MA Environmental Eng.	24
Christopher Oprandi	Operations Mgr.	BA Chemistry	8
George Gatlin, Jr.	Quality Assurance Mgr.	BA Chemistry	11
Anita Castora	Records Mgr.	Work Experience	7
Shawn Ritts	Safety Director	BA Biology	4
Kristine Crock	Inorg. Tech. Advisor	BA Chemistry	6
Brian Greenwell	Org. Tech. Advisor	MA Geochemistry	8
Ray Risden	Extractions Supervisor	BS Biology	3
Brad Belding	GC Semivoc. Supervisor	BA Chemistry	9
Mike Horvath	GC Volatiles Supervisor	BA Chemistry	5
Tom Hula	MS Semivoc. Supervisor	BA Chemistry	11
Tom Stiller	MS Volatiles Supervisor	BS Biology	11
Al Haidet	Shipping Supervisor	Work Experience	16
Lois Ezzo	Sample Control Supervisor	BA - Biology	6
Brian Haueter	Maintenance Supervisor	Work Experience	4
Duane Nielsen	FAS Mgr.	Work Experience	5
Susan Palmer	Metals Supervisor	BA Chemistry	5
Joanne Hancock	General Chem. Supervisor	MA Chemistry	2
Debora Hula	Project Management Dir.	BA Chemistry	10
Alesia Danford	Project Management	Work Experience	10
Karen Groff	Project Management	BA Chemistry	5
Tom Himes	Project Management	BA Biology	7
Carol Kralik	Project Management	MA Microbiology	8
Denise Pohl	Project Management	BA Biology	16
Brian Smith	Project Management	BA Biology	4
Jeff Smith	Project Management	AS Fire Sci	13
Becki Strait	Project Management	MA Intl Bus	10
Dan Wright	Project Management	BA Biology	7

Facility Appendix
North Canton Laboratory

Section North Canton-2

Instrument
List

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TABLE 2-1
NORTH CANTON LABORATORY
Instrument List

Instrument Type	Manufacturer	Model	Purchase Date	Autosampler
GC/MS:	Finnigan	Incos XL	11/27/92	Yes
	Finnigan	Incos-50B	5/21/90	Yes
	Finnigan	Incos-50B	3/28/90	Yes
	Hewlett Packard	5971A	Leased	Yes
	Hewlett Packard	5970	10/1/90	Yes
	Finnigan	OWA-20C	12/1/84	Yes
	Tracor w/ Tekmar	540 HALL/PID	7/1/86	Yes
	Extrel	ELQ-400	3/28/91	Yes
	Extrel	ELQ-400	10/1/88	Yes
	Extrel	ELQ-400	4/15/89	Yes
	Extrel	ELQ-400	5/1/92	Yes
HPLC:	Waters	600E - UV Fluoresence	9/15/92	Yes
GC:	Hewlett Packard	5890 FID/HALL	1/1/86	Yes
	Tracor	540 PID/FID	4/1/89	Yes
	Tracor	540 PID/PID	2/21/90	Yes
	Tracor	540 PID/PID	1/26/89	Yes
	Tracor	540 HALL/PID	11/1/87	Yes
	Tracor	540 HALL/PID	10/1/87	Yes
	Tracor	540 HALL/PID	5/31/88	Yes
	Tracor	540 HALL/PID	10/22/93	Yes
	Tracor	540 HALL/PID	4/8/89	Yes
	Hewlett Packard	5890A DUAL FID	6/13/89	Yes
	Hewlett Packard	5890A DUAL ECD	10/30/90	Yes
	Hewlett Packard	5890-Series II w/EPC & DUAL ECD Y-splitter	12/15/92	Yes
	Hewlett Packard	5890-Series II w/EPC & UAL ECD Y-splitter	7/1/87	Yes

TABLE 2-1
NORTH CANTON LABORATORY
Instrument List
(Continued)

Instrument Type	Manufacturer	Model	Purchase Date	Autosampler
GC: (continued)	Hewlett Packard	5890-Series II w/EPC & DUAL ECD Y-splitter	4/6/89	Yes
	Hewlett Packard	5890A DUAL ECD w/ Y-splitter	1/1/86	Yes
	Hewlett Packard	5890-Series II w/EPC & DUAL ECD Y-splitter	7/1/86	Yes
	Hewlett Packard	5890-Series II w/EPC & DUAL ECD Y-splitter	1/1/86	Yes
	Hewlett Packard	5890A DUAL FID	10/22/93	Yes
	Hewlett Packard	5890-Series II w/EPC & DUAL ECD Y-splitter	9/1/86	Yes
	Hewlett Packard	5880A FID	4/8/89	Yes
	Hewlett Packard	5890A DUAL FPD	4/1/89	Yes
	Hewlett Packard	5890A DUAL FID w/Y-splitter	10/31/90	Yes
	Hewlett Packard	5890A DUAL FID	12/15/92	Yes
	Hewlett Packard	5890A FID	5/31/88	Yes
	Hewlett Packard	5890A DUAL ECD	1/26/89	Yes
	Hewlett Packard	5890A DUAL FID	9/1/86	Yes
	Hewlett Packard	5890A DUAL ECD	10/31/90	Yes
ICP:	Thermal Jarrell Ash	Trace Analyzer	2/1/94	Yes
	Varian	3560 Simultaneous	10/23/91	Yes
	Varian	3560 Simultaneous	8/9/91	Yes

TABLE 2-1
NORTH CANTON LABORATORY
Instrument List
(Continued)

Instrument Type	Manufacturer	Model	Purchase Date	Autosampler
METALS/ MERCURY:	Varian	SpectrAA-20	1/30/89	Yes
METALS/ GFAA:	Varian	SpectrAA-400	11/22/88	Yes
	Varian	SpectrAA-400	7/7/88	Yes
	Varian	SpectrAA-400	11/21/88	Yes
	Varian	SpectrAA-400	2/8/90	Yes
TRAACS:	Bran & Luebbe	800	5/7/93	Yes
	Bran & Luebbe	800	4/1/89	Yes
TOX:	Mitsubishi	TOX-10	11/6/89	No
	Mitsubishi	TOX-10E	5/1/87	No
CONDUCITIVITY (2)	YSI	35	11/13/89	No
INFRARED	Perkin-Elmer	710B	1/15/90	No
ION ANALYZER	Orion	EA940	1/1/85	No
pH METER	Orion	250A	12/1/85	No
	Orion	SA720	6/1/91	No
TOC:	OI	700	2/1/85	Yes
UV/VIS:	Hach	PC900	1/4/93	No
	Milton Roy	Spectronic 401	8/13/93	No

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Facility Appendix
North Canton Laboratory

Section North Canton-3

Standard
Operating
Procedures

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TABLE 3-1
NORTH CANTON LABORATORY
Standard Operating Procedure List

SOP No.	Rev. No.[1]	Rev. Date	Title
NC-WC-0009	0	05/18/95	pH Paper Method
LM-WALN-1002	0	04/27/95	pH Electrometric Method
NC-WC-0017	0	Draft	Total Organic Carbon (TOC)
LM-WALN-1071	0	07/14/94	Total Organic Carbon (TOC) for Solids
NC-WC-0019	0	05/16/95	Chemical Oxygen Demand (COD) (Colorimetric)
NC-WC-0020	1	06/08/95	Chloride Titrimetric
NC-WC-0013	1	Draft	Chloride - Automated Ferricyanide
LM-WALN-1141	2	05/04/95	Cyanide, Automated Pyridine-Barbituric Acid Method
LM-WALN-1142	1	03\20\95	Cyanide Distillation Method
NC-WC-0035	0	Draft	Fluoride (ISE)
NC-WC-0036	0	05/12/95	Total Hardness (mg/L $CaCO_3$)
NC-WC-0001	0	Draft	Nitrite, Nitrate/Nitrite, and Nitrate Automated
NC-WC-0038	0	Draft	Ammonia (ISE)
NC-WC-0039	0	Draft	Ammonia Nitrogen Distillation/Titration
NC-WC-0056	0	Draft	Nitrogen, Ammonia (Automated)
NC-WC-0050	0	Draft	Phosphates: Total, Ortho, and Organic
NC-WC-0004	0	05/31/95	Total Solids, Percent Moisture, Ash and Total Volatile Solids
LM-WALN-1302	0	08/02/94	Total Dissolved Solids (TDS)
NC-WC-0058	0	Draft	Sulfate (Turbidimetric)
NC-WC-0059	0	Draft	Sulfate (Automated)
LM-WALN-1330	1	03/21/95	Sulfide
NC-WC-0073	1	06/12/95	Solid Extraction for Wet Chemistry Parameters

TABLE 3-1
NORTH CANTON LABORATORY
Standard Operating Procedure List
(Continued)

SOP No.	Rev. No.[1]	Rev. Date	Title
LM-WALN-2010	1.2	12/07/94	Graphite Furnace Analysis
LM-WALN-2030	1.3	03/20/95	Mercury Water Analysis
NC-MT-0005	0	05/15/95	Mercury Solid Analysis
NC-MT-0006	1	05/30/95	Inductively Coupled Plasma
LM-WALN-2500	0	08\31\94	Aqueous GFAA Preparation for Total Metals
NC-IP-0002	0	05/12/95	Arsenic & Selenium GFAA Preparation
NC-IP-0003	0	05/30/95	Aqueous ICP & FLAA Preparation for Total Metals
LM-WALN-2530	1	03/21/95	Acid Digestion of Sediment, Sludges, and Soils for Metal Analysis by GFAA, FLAA, or ICP
NC-MS-0002	0	5/3/95	GC/MS Volatile Organics, Method 8260
NC-MS-0004	0	5/9/95	GC/MS Semivolatile/Capillary Column, Method 8270
LM-WALN-4060	5.6	3/21/95	Pesticide/PCB, Organochlorine, Method 8080/8081
LM-WALN-4120	0	Draft	VPH by Gas, as GC Purge & Trap
NC-GC-0013	0	Draft	TPH by GC (current - no surrogates), Extractable
NC-GC-0014	0	Draft	TPH by GC (no surrogates) California Method

TABLE 3-1
NORTH CANTON LABORATORY
Standard Operating Procedure List
(Continued)

SOP No.	Rev. No.[1]	Rev. Date	Title
NC-OP-0003	0	5/19/95	Continuous Liquid/Liquid
NC-OP-0004	0	5/15/95	Soxhlet Low-Level
NC-OP-0005	0	5/23/95	Soxhlet Medium-Level
NC-OP-0006	0	3/20/95	Sonication Low-Level
NC-OP-0011	0	5/11/95	Mercury Cleanup
NC-OP-0012	0	6/8/95	Tetrabutylammonium Cleanup
NC-OP-0013	0	5/23/95	Sulfuric Acid Cleanup
NC-OP-0014	0	5/15/95	Silica Gel Florisil® Cleanup
LM-WALN-6000	0	08/01/94	PAHs by HPLC
LP-WALN-8050	0	03/03/95	Sample Receiving
NC-SC-0001	0	3/6/95	Sample Control
NC-SC-0007	0	6/16/95	Sample Identification SOP
NC-SC-0008	0	Draft	Sample Storage
NC-QA-0009	0	6/16/95	Laboratory and Sample Security
NC-QA-0002	0	3/6/95	Bottle Blank SOP
NC-QA-0015	0	6/16/95	Equipment Monitoring

Footnotes

(1) O = Original

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Facility Appendix

North Canton Laboratory

Section North Canton-4

Analytical
Methods

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TABLE 4-1
NORTH CANTON LABORATORY
Wet Chemistry Methods

Analytical Parameters	Matrix	Methods			
		NPDES[4]	RCRA (SW846)[5]	CLP[6]	Other
Ammonia	Water	Method 350.2, Method 350.3	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 350.2, Method 350.3	Not Applicable	Not Applicable	Not Applicable
Chloride	Water	Method 325.2 - Automated Method 325.3[1] - Manual	Method 9251, 9252	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 325.2 Mod.	Not Applicable	Not Applicable	Not Applicable
COD	Water	Method 410.4	Not Applicable	Not Applicable	SM 508B
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 410.4 Mod.	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
NORTH CANTON LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[4]	RCRA (SW846)[5]	CLP[6]	Other
Cyanide (Total)	Water	Method 335.3[2], 335.2	Method 9012, 9010	Method CLP	Not Applicable
	Liquid	Method 335.3	Method 9012	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 335.3[2], 335.2	Method 9012, 9010	Method CLP	Not Applicable
Fluoride	Water	Method 340.2[2]	Not Applicable	Not Applicable	SM 4500-F
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 340.2 **Mod w/Fusion Extraction of Leachate**	Not Applicable	Not Applicable	Not Applicable
Hardness (Total)	Water	Method 130.2	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
NORTH CANTON LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[4]	RCRA (SW846)[5]	CLP[6]	Other
Nitrate plus Nitrite	Water	Method 353.2 353.2	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 353.2-Mod.	Not Applicable	Not Applicable	Not Applicable
Phosphorus (Total + (Ortho)	Water	Method 365.2[1]	Not Applicable	Not Applicable	Method 365.2 Mod.
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 365.2 Mod	Not Applicable	Not Applicable	Not Applicable
Sulfate (SO_4)	Water	Method 375.2 Method 375.4, Turbidimetric, NPDES approved meth.	Method 9036	Not Applicable	Method 9038
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 9036	Not Applicable	Not Applicable

TABLE 4-1
NORTH CANTON LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[4]	RCRA (SW846)[5]	CLP[6]	Other
Sulfate (SO_4) Continued	Soil	Method 375.2 Method 375.4 Mod	Method 9036 Mod	Not Applicable	Method 9038 Mod
Sulfide (H_2S)	Water	Method 376.1[1]	Method 9030[2]	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Total Organic Carbon (TOC)	Water	Method 415.1[1]	Method 9060[1]	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Walkley Black
	Soil	Not Applicable	Not Applicable	Not Applicable	Walkley Black
Total Solids	Water	Method 160.3[1]	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 160.3 Mod	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
NORTH CANTON LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[4]	RCRA (SW846)[5]	CLP[6]	Other
Total Dissolved Solids	Water	Method 160.1[1]	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 160.1 Mod.	Not Applicable	Not Applicable	Not Applicable

Footnotes

(1) Includes drinking, surface and saline waters, aqueous domestic and industrial waste.

(2) Includes drinking, surface and saline waters

(3) Includes drinking and ground waters

(4) NPDES = National Pollutant Discharge Elimination System

(5) RCRA = Resource Conservation and Recovery Act

(6) CLP = Contract Laboratory Program

TABLE 4-2
NORTH CANTON LABORATORY
ICP Sample Preparation Methods

Analytical Parameters	Matrix	Methods			
		NPDES[1]	RCRA (SW846)[2]	CLP[3]	Other
ICP Metals	Water	Method 200.7 Section 9	Method 3010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 3010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 1311 Method 1312	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Proper pretreatment is described in Section 4, Metals, Methods for Chemical Analysis of Waste Waters or Section 9.2 of Method 200.7	Method 3050	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3050	Method CLP	Not Applicable

Footnotes

(1) NPDES = National Pollutant Discharge Elimination System

(2) RCRA = Resource Conservation and Recovery Act

(3) CLP = Contract Laboratory Program

TABLE 4-3
NORTH CANTON LABORATORY
GFAA and Mercury Sample Preparation Methods

Analytical Parameters	Matrix	Methods			
		NPDES[1]	RCRA (SW846)[2]	CLP[3]	Other
GFAA Metals + Mercury	Water	Element / Method Arsenic 206.2 Antimony 204.2 Lead 239.2 Selenium 270.2 Thallium 279.2 Mercury 245.1	Element / Method Arsenic 3020 Antimony 7041 Lead 3020 Selenium 3020 Thallium 3020 Mercury 7470	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 3020	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 1311 Method 1312 (SPLP)	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Proper pretreatment is described in Section 4, Metals, Methods for Chemical Analysis of Waste Waters	Element / Method Arsenic 3050 Antimony 3050 Lead 3050 Selenium 3050 Thallium 3050 Mercury 7471	Not Applicable	Not Applicable
	Soil	Method 245.5 (soil)	Method 3050 (soil) Method 7471 Mercury (soil)	Method CLP (soil only)	Not Applicable

Footnotes

(1) NPDES = National Pollutant Discharge Elimination System

(2) RCRA = Resource Conservation and Recovery Act

(3) CLP = Contract Laboratory Program

TABLE 4-4
NORTH CANTON LABORATORY
Organic Sample Preparation Methods

Analytical Parameters	Matrix	Methods			
		NPDES(1)	RCRA (SW846)(2)	CLP(3)	Other
Volatiles by GC/MS	Water	Method 624(1)	Method 5030	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 5030	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 5030	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 5030	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 5030	Method CLP	Not Applicable
Semivolatiles by GC/MS	Water	Method 625(1)	Method 3510 3520	Method CLP	3520-A, One-Step
	Liquid	Not Applicable	Method 3580	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 3510 3520A, 1311, 1312 (SPLP)	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 3540 Method 3550	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3540 Method 3550	Method CLP	3580A-Waste Dilution
Pesticides/ PCBs	Water	Method 608[1]	Method 3510 3520	Method CLP	3520A-One Step

TABLE 4-4
NORTH CANTON LABORATORY
Organic Sample Preparation Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[3]	RCRA (SW846)[4]	CLP[5]	Other
Pesticides/ PCBs (continued)	Liquid	Not Applicable	Method 3580	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 3510, 1311, 1312 (SPLP)	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 3540 Method 3550	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3540 Method 3550	Method CLP	Not Applicable
PAHs by HPLC	Water	Not Applicable	Method 3520	Not Applicable	Accelerated One-Step Method 3520 Azeotropic Distillation Method 5031
	Liquid	Not Applicable	Method 3520	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 3550	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3550	Not Applicable	Not Applicable

TABLE 4-4
NORTH CANTON LABORATORY
Organic Sample Preparation Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[3]	RCRA (SW846)[4]	CLP[5]	Other
TPH by GC	Water	Not Applicable	Metod 3520	Not Applicable	Accelerated One-Step Method 3520 Azeotropic Distillation Method 5031
	Liquid	Not Applicable	Method 3520	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 3550	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3550	Not Applicable	Not Appliable

Footnotes

(1) Includes drinking, surface and saline water

(2) SW-846 and NPDES methods are combined to perform this method as per Quanterra North Canton SOP

(3) NPDES = National Pollutant Discharge Elimination System

(4) RCRA = Resource Conservation and Recovery Act

(5) CLP = Contract Laboratory Program

TABLE 4-5
NORTH CANTON LABORATORY
Inorganic ICP Metals Methods

Analytical Parameters	Matrix	Methods			
		NPDES(4)	RCRA (SW846)(5)	CLP(6)	Other
Barium	Water	Method 200.7(1)	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7(2) **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable
Beryllium	Water	Method 200.7(1)	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7(2) **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable
Boron	Water	Method 200.7(1)	Method 6010	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7 (2) **Requires proper pretreatment**	Method 6010	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 6010	Not Applicable	Not Applicable

TABLE 4-5
NORTH CANTON LABORATORY
Inorganic ICP Metals Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[4]	RCRA (SW846)[5]	CLP[6]	Other
Calcium	Water	Method 200.7[1]	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7[2] **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable
Cadmium	Water	Method 200.7[1]	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7[2] **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable
Cobalt	Water	Method 200.7[1]	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7[2] **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable

TABLE 4-5
NORTH CANTON LABORATORY
Inorganic ICP Metals Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES(4)	RCRA (SW846)(5)	CLP(6)	Other
Chromium	Water	Method 200.7(1)	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7(2) **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable
Copper	Water	Method 200.7(1)	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7(2) **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable
Iron	Water	Method 200.7(1)	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7(2) **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable

TABLE 4-5
NORTH CANTON LABORATORY
Inorganic ICP Metals Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES(4)	RCRA (SW846)(5)	CLP(6)	Other
Magnesium	Water	Method 200.7(1)	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7(2) **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable
Manganese	Water	Method 200.7(1)	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7(2) **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable
Nickel	Water	Method 200.7(1)	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7(2) **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable

TABLE 4-5
NORTH CANTON LABORATORY
Inorganic ICP Metals Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[4]	RCRA (SW846)[5]	CLP[6]	Other
Silver	Water	Method 200.7	Method 6010	CLP Method	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7[2] **Requires proper pretreatment**	Method 6010	CLP Method	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable
Sodium	Water	Method 200.7[1]	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7[2] **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable
Vanadium	Water	Method 200.7[1]	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7[2] **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable

TABLE 4-5
NORTH CANTON LABORATORY
Inorganic ICP Metals Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[4]	RCRA (SW846)[5]	CLP[6]	Other
Zinc	Water	Method 200.7[1]	Method 6010	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 6010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 6010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 200.7[2] **Requires proper pretreatment**	Method 6010	Method CLP	Not Applicable
	Soil	Not Applicable	Method 6010	Method CLP	Not Applicable

Footnotes

(1) Includes drinking, surface and saline water, domestic and industrial waste effluents.
(2) This method is not recommended for this matrix.
(3) As, Se, Tl can be analyzed by Trace ICP for CLP Methods
(4) NPDES = National Pollutant Discharge Elimination System
(5) RCRA = Resource Conservation and Reovery Act
(6) CLP = Contract Laboratory Program

TABLE 4-6
NORTH CANTON LABORATORY
Inorganic Graphite Furnace Metals and Mercury Methods

Analytical Parameters	Matrix	Methods			
		NPDES[3]	RCRA (SW846)[4]	CLP[5]	Other
Antimony	Water	Method 204.2[1]	Method 7041	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 7041	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7041	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Method 204.2[2] **Requires proper pretreatment.**	Method 7041	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7041	Method CLP	Not Applicable
Arsenic	Water	Method 206.2[1]	Method 7060	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 7060	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7060	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Method 206.2[2] **Requires proper pretreatment**	Method 7060	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7060	Method CLP	Not Applicable
Lead	Water	Method 239.2[1]	Method 7421	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 7421	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7421	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Method 239.2[2] **Requires proper pretreatment**	Method 7421	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7421	Method CLP	Not Applicable

TABLE 4-6
NORTH CANTON LABORATORY
Inorganic Graphite Furnace Metals and Mercury Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[3]	RCRA (SW846)[4]	CLP[5]	Other
Selenium	Water	Method 270.2[1]	Method 7740	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 7740	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7740	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Method 270.2[2] **Requires proper pretreatment**	Method 7740	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7740	Method CLP	Not Applicable
Thallium	Water	Method 279.2[1]	Method 7841	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 7841	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7841	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Method 279.2[2] **Requires proper pretreatment**	Method 7841	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7841	Method CLP	Not Applicable
Mercury	Water	Method 245.1	Method 7470	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 7470	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7470	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Method 245.5	Method 7471	Not Applicable	Not Applicable
	Soil	Method 245.5	Method 7471	Method CLP	Not Applicable

Footnotes

(1) Includes drinking, surface and saline waters
(2) This method is not recommended for this matrix
(3) NPDES = National Pollutant Discharge Elimination System
(4) RCRA = Resource Conservation and Recovery Act
(5) CLP = Contract Laboratory Program

TABLE 4-7
NORTH CANTON LABORATORY
Organic Methods

Analytical Parameters	Matrix	Methods			
		NPDES[4]	RCRA (SW846)[5]	CLP[6]	Other
Volatiles by GC/MS	Water	Method 624[1]	Method 8240, 8260	Method CLP	Method 524.2
	Liquid	Not Applicable	Method 8240, 8260	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8240, 8260	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 8240, 8260	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8240, 8260	Method CLP	Not Applicable
Volatiles by GC	Water	Method 602, 601, 601/602[1]	Method 8020, 8010, 8021, 8015A Mod	Not Applicable	465C/D, 502.2, 501.1, GRO, VPH, CaLuft
	Liquid	Not Applicable	Method 8020	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8020	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 8020, 8010, 8021, 8015A Mod	Not Applicable	465C/D, GRO, VPH, CaLuft
	Soil	Not Applicable	Method 8020, 8010, 8021, 8015A Mod	Not Applicable	465C/D, GRO, VPH, CaLuft
Semivolatiles by GC/MS	Water	Method 625[1]	Method 8270	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 8270	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8270	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 8270	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8270	Method CLP	Not Applicable

TABLE 4-7
NORTH CANTON LABORATORY
Organic Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[4]	RCRA (SW846)[5]	CLP[6]	Other
Pesticides/ PCBs	Water	Method 608[1]	Method 8080/8081	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 8080/8081	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8080/8081	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 8080/8081	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8080/8081	Method CLP	Not Applicable
TPH by GC	Water	Not Applicable	Meth 8015A Mod.	Not Applicable	Not Applicable
	Liquid	Not Applicable	Meth 8015A Mod.	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Meth 8015A Mod.	Not Applicable	Not Applicable
	Soil	Not Applicable	Meth 8015A Mod.	Not Applicable	Not Applicable

Footnotes

(1) Includes drinking, surface and saline water
(2) Drinking Water Methods
(3) SW-846 and NPDES methods are combined to perform TPHC analysis, this is done according to Quanterra North Canton SOP.
(4) NPDES = National Pollutant Discharge Elimination System
(5) RCRA = Resource Conservation and Recovery Act
(6) CLP = Contract Laboratory Porgram

TABLE 4-8
NORTH CANTON LABORATORY
Organic Cleanup Methods

Analytical Parameters	Matrix	Methods			
		NPDES[1]	RCRA (SW846)[2]	CLP[3]	Other
Volatiles by GC/MS	Water	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Semivolatiles by GC/MS	Water	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 3640, GPC	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 3640, GPC	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3640, GPC	Method CLP, GPC	Not Applicable
PAHs by HPLC	Water	Method 610	Method 8310	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 8310	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 8310	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8310	Not Applicable	Not Applicable

TABLE 4-8
NORTH CANTON LABORATORY
Organic Cleanup Methods
(Continued)

Analytical Parameters	Matrix	Methods			
		NPDES[1]	RCRA (SW846)[2]	CLP[3]	Other
Pesticides/ PCBs	Water	Not Applicable	Method 3610, Method 3620 Florisil Cleanup, Method 3660 Sulfur Cleanup	Method CLP Florisil Cleanup	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 3640 GPC, Method 3610, Method 3620 Florisil Cleanup, Method 3660 Sulfur Cleanup	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3640 GPC, Method 3610, Method 3620 Florisil Cleanup, Method 3660 Sulfur Cleanup	Method CLP, GPC and Florisil Cleanup	Not Applicable

Footnotes

(1) NPDES = National Pollutant Discharge Elimination System

(2) RCRA = Resource Conservation and Recovery Act

(3) CLP = Contract Laboratory Program

Facility Appendix

North Canton Laboratory

Section North Canton-5

MDLs and RLs

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TABLE 5-1
NORTH CANTON LABORATORY
ICP Metals
Method 6010, SW-846
Method Detection Limits (MDL),
and Practical Quantitation Limits (PQL)

Element	CAS Number	Estimated IDL(1) (µg/L)	Water MDL (µg/L)	PQL Factor	Water PQL(3) (µg/L)	Soil MDL (mg/Kg)	PQL Factor	Soil PQL(3) (mg/Kg)
Barium	7440-39-3	2	1.53	131	200	0.17	118	20
Beryllium	7440-41-7	1.19	4.20	3.1	5	0.17	2.94	0.5
Boron	7440-42-8	-2	63	3.17	200	2.85	7.02	20
Cadmium	7440-43-9	4	5.44	0.92	5	0.61	0.82	0.5
Calcium	7440-70-2	10	121	41.3	5000	7.96	62.8	500
Chromium	7440-47-3	7	7.45	1.34	10	0.88	1.14	1
Cobalt	7440-48-4	7	16.7	2.99	50	1.05	4.76	5
Copper	7440-50-8	6	2.57	9.73	25	25	0.15	2.5
Iron	7439-89-6	7	33.0	3.03	100	4.14	2.42	10
Magnesium	7439-95-4	30	38.4	130	5000	4.66	107	500
Manganese	7439-96-5	2	3.36	4.46	15	0.30	5.0	1.5
Nickel	7440-02-0	15	19.1	2.09	40	1.86	2.15	4
Silver	7440-22-4	7	5.04	1.98	10	0.36	2.78	1
Sodium	7440-23-5	29	187	26.7	5000	24.0	20.8	500
Vanadium	7440-62-2	8	13.7	3.73	50	0.51	9.80	5
Zinc	7440-66-6	2	6.99	2.86	20	1.45	1.38	2

Footnotes

(1) The estimated instrument detection limits are given as a guide for an instrumental limit. The actual method detection limits are sample dependent and may vary as the sample matrix varies.

(2) This element is not part of the SW-846 method.

(3) PQL = MDL X PQL Factor

(4) Not Determined

TABLE 5-2
NORTH CANTON LABORATORY
GFAA Metals and Mercury
7000A Methods, SW-846
Method Detection Limits (MDL), and
Practical Quantitation Limits (PQL)

Element	CAS Number	Method Water MDL (µg/L)	Method Soil MDL[1,5] (mg/Kg)	Water MDL (µg/L)	PQL Factor	Water PQL[4] (µg/L)	Soil MDL[2,5] (mg/Kg)	PQL Factor[5]	Soil PQL[4] (mg/Kg)
Arsenic	7440-38-2	1	ND	4.42	2.26	10	0.468	2.14	1.0
Lead	7439-92-1	1	ND	0.87	3.45	3	0.156	1.92	0.3
Selenium	7782-49-2	2	ND	0.97	5.15	5	0.132	3.79	0.5
Thallium	7440-28-0	1	ND	0.92	10.9	10	0.111	9.01	1.0
Antimony	7440-36-0	3	ND	3.00	3.33	10	0.239	4.18	1.0
Mercury[3]	7439-97-6	0.2	ND	0.03	6.67	0.2	0.029	3.45	0.1

Footnotes

(1) Method 7000A states detection limits for waters only.

(2) Soil detection limit for Hg is based on a 0.2 gram sample digestion with a final volume of 100 mL. GFAA metals soil detection limit is based on one gram digestion with a final volume of 100 mL.

(3) Analyzed by Cold vapor AA.

(4) PQL = MDL X PQL Factor

(5) ND = Not Determined

TABLE 5-3
NORTH CANTON LABORATORY
General Chemistry
Method Detection Limits (MDL) and Reported Detection Limit (RDL)

Parameter	Method	Water MDL (mg/L)	Water RDL[1] (mg/L)	Soil RDL[1] (mg/Kg)
Ammonia	350.1	0.02	0.2	-
Chloride	325.2	0.93	2	-
Chloride	325.3	0.71	2	-
COD	410.4	15	20	-
Cyanide, Total	335.3, 9010	0.003	0.005	0.5
Fluoride	340.2	0.007	0.1	-
Hardness (Total)	130.2	5	5	-
Nitrate/Nitrite	353.1	0.012	0.1	-
Phosphorus, Total	365.2	0.038	0.1	-
Sulfate	375.4	2.3	5	-
Sulfide	376.1, 9030	0.36	1	50
Total Solids	160.3	10	0.5%	-
Total Dissolved Solids	160.1	5.5	10	-
Total Organic Carbon	415.1, 9060	0.86	1	100

Footnotes

(1) RDL = Reporting Detection Limits.

TABLE 5-4
NORTH CANTON LABORATORY
Semivolatiles Method 8270
Method Detection Limits (MDL)[1,2] and Practical Quantitation Limits (PQL)[1,3]

Analyte	CAS Number	Method Water PQL (µg/L)	Method Soil PQL[4] (µg/Kg)	Water MDL (µg/L)	PQL Factor	Water PQL (µg/L)	Soil MDL (µg/Kg)	PQL Factor	Soil PQL (µg/Kg)
Phenol	108-95-2	10	330	3.24	3.09	10	91.7	3.6	330
bis(2-Chloroethyl)-ether	111-44-4	10	330	3.40	2.94	10	87.4	3.78	330
2-Chlorophenol	95-57-8	10	330	3.17	3.15	10	63.7	5.18	330
Carbazole		10	330	4.78	2.09	10	111	2.97	330
o-Cresol		10	330	8.05	1.24	10	79.7	4.14	330
m-Cresol	95-48-7	10	330	3.52	2.84	10	78.3	4.4	330
bis (2-chloroisopropy l)ether	108-60-1	10	330	3.02	3.31	10	137	2.41	330
p-Cresol	106-44-5	10	330	8.05	1.24	10	79.7	4.14	330
n-Nitroso-di-n-Propylamine	621-64-7	10	330	3.22	3.10	10	156	2.12	330
Hexachloro-ethane	67-72-1	10	330	3.83	2.61	10	85.5	3.86	330
Nitrobenzene	98-95-1	10	330	2.82	3.55	10	103	3.2	330
Isophorone	78-59-1	10	330	3.29	3.04	10	127	2.6	330
2-Nitrophenol	88-75-5	10	330	2.56	3.91	10	83.3	3.96	330

TABLE 5-4
NORTH CANTON LABORATORY
Semivolatiles Method 8270
Method Detection Limits (MDL)[1,2] and
Practical Quantitation Limits (PQL)[1,3]
(Continued)

Analyte	CAS Number	Method Water PQL (µg/L)	Method Soil PQL[4] (µg/Kg)	Water MDL (µg/L)	PQL Factor	Water PQL (µg/L)	Soil MDL (µg/Kg)	PQL Factor	Soil PQL (µg/Kg)
2,4-Dimethyl-phenol	150-67-9	10	330	5.33	1.88	10	106	3.11	330
bis(2-Chloroethoxy) methane	111-91-1	10	330	2.99	3.34	10	83.4	3.96	330
2,4-Dichloro-phenol	120-83-2	10	330	3.55	2.82	10	140	2.36	330
1,2,4-Trichloro-benzene	120-82-1	10	330	3.28	3.05	10	84.6	3.9	330
Naphthalene	91-20-3	10	330	2.59	3.86	10	108	3.06	330
4-Chloroaniline	106-47-8	20	1300	6.95	1.44	10	66	5	330
Hexachloro-butadiene	87-68-3	10	330	2.91	3.44	10	95.8	3.44	330
4-Chloro-3-methylphenol	59-50-7	20	330	3.71	2.70	10	178	2.8	330
2-Methyl-naphthalene	91-57-6	10	330	2.89	3.46	10	63.1	5.23	330
Hexachloro-cyclopenta-diene	77-47-4	10	330	ND	ND	50	75	21.3	1600
2,4,6-Trichloro-phenol	88-06-2	10	330	3.12	3.20	10	78	1.23	330
2,4,5-Tricholoro-phenol	95-95-4	10	330	3.21	3.12	10	140	2.36	330

TABLE 5-4
NORTH CANTON LABORATORY
Semivolatiles Method 8270
Method Detection Limits (MDL)[1,2] and
Practical Quantitation Limits (PQL)[1,3]
(Continued)

Analyte	CAS Number	Method Water PQL (μg/L)	Method Soil PQL[4] (μg/Kg)	Water MDL (μg/L)	PQL Factor	Water PQL (μg/L)	Soil MDL (μg/Kg)	PQL Factor	Soil PQL (μg/Kg)
2-Chloronaphthalene	91-58-7	10	3300	2.83	3.53	10	81.1	4.07	330
2-Nitroaniline	88-74-4	50	1600	3.12	16.0	50	120	13.3	1600
Dimethylphthalate	31-11-3	10	330	2.99	3.34	10	141	2.34	330
Acenaphthylene	208-96-8	10	330	3.21	3.12	10	93.7	3.52	330
3-Nitroaniline	99-09-2	50	1600	4.30	11.6	50	29.5	54.2	1600
Acenaphthene	83-32-9	10	3300	3.45	2.90	10	104	3.17	330
2,4-Dinitrophenol	51-28-5	50	1600	4.06	12.3	50	446	3.59	1600
4-Nitrophenol	100-02-7	50	1600	5.10	9.80	50	640	2.5	1600
Dibenzofuran	132-64-9	10	330	2.96	3.38	10	125	2.64	330
2,4-Dinitrotoluene	121-14-2	10	330	3.58	2.79	10	204	1.62	330
2,6-Dinitrotoluene	606-20-2	10	330	3.81	2.62	10	156	2.12	330
Diethylphthalate	84-66-2	10	330	2.99	3.34	10	152	2.17	330
4-Chlorophenylphenylether	7005-72-36	10	330	2.95	3.39	10	142	2.32	330
Fluorene	96-73-7	10	330	3.22	3.10	10	143	2.31	330
4-Nitroaniline	100-01-6	50	1600	6.23	8.02	50	146	11	1600
4,6-Dinitro-2-methylphenol	534-52-1	50	1600	3.69	13.6	50	168	9.5	1600

TABLE 5-4
NORTH CANTON LABORATORY
Semivolatiles Method 8270
Method Detection Limits (MDL)[(1,2)] and
Practical Quantitation Limits (PQL)[(1,3)]
(Continued)

Analyte	CAS Number	Method Water PQL (µg/L)	Method Soil PQL[(4)] (µg/Kg)	Water MDL (µg/L)	PQL Factor	Water PQL (µg/L)	Soil MDL (µg/Kg)	PQL Factor	Soil PQL (µg/Kg)
n-Nitroso-diphenylamine	96-30-6	10	330	3.99	2.51	10	141	2.34	330
4-Bromo-phenyl-phenylether	101-55-3	10	330	3.66	2.73	10	111	2.97	330
Pentachloro-phenol	87-86-5	50	1600	4.29	11.6	50	95.5	16.8	1600
Phenanthrene	85-01-8	10	330	3.56	2.81	10	165	2	330
Anthracene	120-12-7	10	330	3.56	2.81	10	114	2.89	330
Di-n-Butylphthalate	84-74-2	10	330	4.30	2.32	10	120	2.75	330
Fluoranthene	206-44-0	10	330	3.72	2.69	10	110	3	330
Pyrene	129-00-0	10	330	4.15	2.41	10	270	1.22	330
Butylbenzylphtha late	85-68-7	10	330	4.03	2.72	10	168	1.96	330
3,3'-Dichloro-benzidine	91-94-1	20	660	7.81	6.40	50	539	2.97	1600
Chrysene	218-01-9	10	330	3.69	2.71	10	150	2.2	330
bis(2-Ethylhexyl)-phthalate	117-81-7	10	330	4.80	2.08	10	186	1.77	330
Di-n-Octylphthalate	117-84-0	10	330	4.43	2.26	10	188	1.76	330

TABLE 5-4
NORTH CANTON LABORATORY
Semivolatiles Method 8270
Method Detection Limits (MDL)[1,2] and
Practical Quantitation Limits (PQL)[1,3]
(Continued)

Analyte	CAS Number	Method Water PQL (µg/L)	Method Soil PQL[4] (µg/Kg)	Water MDL (µg/L)	PQL Factor	Water PQL (µg/L)	Soil MDL (µg/Kg)	PQL Factor	Soil PQL (µg/Kg)
Benzo(k)-fluoranthene	207-08-9	10	330	4.48	2.23	10	114	2.89	330
Benzo(g,h,i)-perylene	191-24-2	10	330	3.53	2.83	10	169	1.95	330

Footnotes

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) The MDL study is performed according to specifications in 40 CFR Part 136 Appendix B.

(3) PQL = MDL X PQL Factor

(4) Quantitation limits listed for soil are based on wet weight. The quantitation limits based on dry weight as required, will be higher. This is based on a 30-g sample and gel permeation chromatography cleanup.

ND = Not Determined

TABLE 5-5
NORTH CANTON LABORATORY
Total Petroleum Hydrocarbons - Method 8015A -Modified
Method Detection Limit [3](MDL) and Practical Quantitation Limits (PQL)

Analyte	CAS Number	Method Water MDL[1] (µg/L)	Low Soil (µg/Kg)	Water MDL (µg/L)	PQL Factor	Water PQL[1] (µg/L)	Soil MDL (µg/Kg)	PQL Factor	Soil PQL[4] (µg/Kg)
Gasoline Range Organics	N/A	ND	ND	25.4	3.93	100	2100	4.76	10000
Disel Range Organics	N/A	ND	ND	92.4	1.08	100	2400	4.16	10000

TABLE 5-6
NORTH CANTON LABORATORY
Pentachlorophenol - Method 8150A/8151
Method Detection Limit (MDL) and Practical Quantitation Limits (PQL)

Analyte	CAS Number	Method Water MDL[1] (µg/L)	Low Soil (µg/Kg)	Water MDL (µg/L)	PQL Factor	Water PQL[1] (µg/L)	Soil MDL[4] (µg/Kg)	PQL Factor	Soil PQL[4] (µg/Kg)
Pentachloro-phenol	87-86-5	0.076	0.016	ND	ND	0.1	ND	ND	0.1

Footnotes

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) PQL = MDL X PQL Factor

(3) The MDL study is performed according to specifications in 40 CFR Part 136 Appendix B.

(4) Quantitation limits listed for soil are based on wet weight. The quantitation limits based on dry weight as required, will be higher. This is based on a 30-g sample and gel permeation chromatography cleanup.

ND = Not Determined

N/A = Not Applicable

Table 5-7
NORTH CANTON LABORATORY
Pesticides/PCB Method 8080/8081
Method Detection Limit (MDL) and Practical Quantitation Limits (PQL)

Analyte	CAS Number	Method Water MDL(1,3) (µg/L)	Low Soil(3) (µg/Kg)	Water MDL(4) (µg/L)	PQL Factor	Water PQL(1,2) (µg/L)	Soil MDL(4) (µg/Kg)	PQL Factor	Soil PQL(1,2) (µg/Kg)
alpha-BHC	319-84-6	0.003	ND	0.005	10	0.05	0.417	3.61	1.7
beta-BHC	319-85-7	0.006	ND	0.028	1.78	0.05	0.456	3.73	1.7
delta-BHC	319-86-8	0.009	ND	0.014	3.57	0.05	0.545	3.12	1.7
gamma-BHC (Lindane)	58-89-9	0.004	ND	0.007	7.14	0.05	1.953	0.87	1.7
Heptachlor	76-44-8	0.003	ND	0.007	7.14	0.05	2.060	0.83	1.7
Aldrin	309-00-2	0.004	ND	0.012	4.17	0.05	0.346	4.91	1.7
Heptachlor epoxide	1024-57-3	0.083	ND	0.013	3.85	0.05	0.450	3.78	1.7
Endosulfan I	959-98-8	0.014	ND	0.008	6.25	0.05	0.556	3.06	1.7
Dieldrin	60-57-1	0.002	ND	0.011	4.54	0.05	1.180	1.44	1.7
4,4-DDE	72-55-9	0.004	ND	0.016	3.12	0.05	0.644	2.64	1.7
Endrin	72-20-8	0.006	ND	0.005	10	0.05	1.21	1.40	1.7
Endosulfan II	33213-65-9	0.004	ND	0.014	3.57	0.05	0.598	2.84	1.7
4,4-DDD	72-54-8	0.011	ND	0.014	3.57	0.05	1.41	1.20	1.7
Endosulfan Sulfate	1031-07-8	0.066	ND	0.035	1.43	0.05	0.759	2.24	1.7
4,4-DDT	50-29-3	0.012	ND	0.031	1.61	0.05	0.936	1.82	1.7
Methoxychlor	72-43-5	0.18	ND	0.065	1.54	0.1	7.41	0.44	3.3
Endrin aldehyde	7421-93-4	0.023	ND	0.020	2.50	0.05	1.02	1.67	1.7
Endrin Ketone	53494-70-5	ND	ND	0.012	4.17	0.05	0.513	3.31	1.7
alpha-Chlordane	5103-71-9	0.008	ND	0.009	5.56	0.05	0.451	3.77	1.7

TABLE 5-7
NORTH CANTON LABORATORY
Pesticides/PCB Method 8080/8081
Method Detection Limit (MDL) and Practical Quantitation Limits (PQL)
(Continued)

Analyte	CAS Number	Method Water MDL(1,3) (µg/L)	Low Soil(3) (µg/Kg)	Water MDL(4) (µg/L)	PQL Factor	Water PQL(1,2) (µg/L)	Soil MDL(4) (µg/Kg)	PQL Factor	Soil PQL(1,2) (µg/Kg)
gamma-Chlordane	5103-74-2	0.037	ND	0.009	5.56	0.05	0.451	3.77	1.7
Hexachloro-benzene	118-74-1	ND	ND	0.0125	4.0	0.05	0.546	3.11	1.7
Toxaphene	8001-35-2	0.24	ND	0.518	3.86	2	26.9	2.49	67
Aroclor 1016	12674-11-2	ND	ND	0.037	27.0	1	5.18	6.37	33
Aroclor 1221	11104-28-2	ND	ND	0.072	13.9	1	8.06	4.07	33
Aroclor 1232	11141-16-5	ND	ND	0.067	14.9	1	6.61	4.99	33
Aroclor 1242	53469-21-9	0.065	ND	0.081	12.3	1	5.97	5.53	33
Aroclor 1248	12672-29-6	ND	ND	0.118	8.47	1	4.12	8.01	33
Aroclor 1254	11097-69-1	ND	ND	0.105	9.52	1	7.55	4.37	33
Aroclor 1260	11096-82-5	ND	ND	0.098	10.2	1	10.1	3.27	33

Footnotes

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) PQL = MDL X PQL Factor

(3) ND = Not Determined

(4) The MDL study performed according to specifications in 40 CFR Part Appendix B.

TABLE 5-8
NORTH CANTON LABORATORY
Method 8310 Polynuclear Aromatic Hydrocarbons
Method Detection Limits (MDL) and
Practical Quantitation Limits (PQL)[1]

Analyte	CAS Number	Method Water MDL[5] (µg/L)	Method Soil MDL[5] (µg/Kg)	Water MDL[2] (µg/L)	PQL Factor	Water PQL[3] (µg/L)	Soil MDL[2,5] (µg/Kg)	PQL Factor[5]	Soil PQL[3,4] (µg/Kg)
Benzo(a)-anthracene	56-55-3	0.013	ND	0.061	3.28	0.2	0.39	102	40
Benzo(a)pyrene	50-32-8	0.023	ND	0.048	4.17	0.20	0.59	67.8	40
Benzo(b)-fluoranthene	205-99-2	0.018	ND	0.055	3.64	0.2	0.26	154	40
Dibenzo(a,h)-anthracene	53-70-3	0.030	ND	0.031	6.45	0.20	0.86	46.5	40
Indeno(1,2,3-cd)pyrene	193-39-5	0.043	ND	0.097	2.06	0.2	1.32	30.3	40

Footnotes

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) The Method Detection Limit study performed according to the specifications in 40 CFR Part 136 Appendix B.

(3) PQL = MDL X PQL Factor

(4) Quantitation limits listed for soil are based on wet weight. The quantitation limits based on dry weight as required, will be higher.

(5) ND = Not Determined

TABLE 5-9
NORTH CANTON LABORATORY
Method 8260 Volatile Organics - 25 mL Purge
Method Detection Limits (MDL) and
Practical Quantitation Limits (PQL)[1]

Analyte	Method Water MDL[4,6] (µg/L)	Method Water EQL[5,6] (µg/L)	Water MDL[2] (µg/L)	PQL Factor	Water PQL[3] (RDL) (µg/L)	Method Soil EQL[5,6] (µg/Kg)	Soil MDL[2,6] (µg/Kg)	Soil RDL[7] µg/Kg
Chloromethane	0.13	5	0.903	11.07	10	5	ND	10
Vinyl Chloride	0.17	5	1.302	7.68	10	5	ND	10
Bromomethane	0.11	5	1.335	7.49	10	5	ND	10
Chloroethane	0.10	5	1.519	3.3	5	5	ND	5
Trichlorofluoromethane	0.08	5	2.547	3.93	10	5	ND	10
1,1-Dichloroethene	0.12	5	2.035	2.46	5	5	ND	5
Methylene Chloride	0.03	5	1.446	3.46	5	5	ND	5
trans-1,2-Dichloroethene	0.06	5	1.594	3.14	5	5	ND	5
1,1-Dichloroethane	0.04	5	1.554	3.22	5	5	ND	5
cis-1,2-Dichloroethene	0.12	5	0.995	5.03	5	5	ND	5
Chloroform	0.03	5	1.463	3.42	5	5	ND	5
Bromochloromethane	0.04	5	0.952	5.25	5	5	ND	5
1,1,1-Trichloroethane	0.08	5	1.107	4.52	5	5	ND	5
Carbon tetrachloride	0.21	5	1.107	4.52	5	5	ND	5
Benzene	0.04	5	1.029	4.86	5	5	ND	5
1,2-Dichloroethane	0.06	5	1.186	4.22	5	5	ND	5
Trichlorethene	0.19	5	0.996	5.02	5	5	ND	5
1,2-Dichloropropane	0.04	5	1.104	4.53	5	5	ND	5
Bromodichloromethane	0.08	5	0.884	5.66	5	5	ND	5

TABLE 5-9
NORTH CANTON LABORATORY
Method 8260 Volatile Organics - 25 mL Purge
Method Detection Limits (MDL) and
Practical Quantitation Limits (PQL)(1)
(Continued)

Analyte	Method Water MDL(4,6) (µg/L)	Method Water EQL(5,6) (µg/L)	Water MDL(2) (µg/L)	PQL Factor	Water PQL(3) (RDL) (µg/L)	Method *Soil* EQL(5,6) (µg/Kg)	*Soil* MDL(2,6) (µg/Kg)	*Soil* RDL(7) µg/Kg
Dibromomethane	0.24	5	1.521	3.29	5	5	ND	5
trans-1,3-Dichloropropene	ND	ND	1.033	4.8	5	ND	ND	5
2-Hexanone	ND	ND	2.596	3.852	10	ND	ND	10
Cis-1,2-Dichloropropene	ND	ND	0.781	6.402	5	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	1.542	6.485	10	ND	ND	10
2-Butanone	ND	ND	3.517	2.843	10	ND	ND	10
Vinyl Acetate	ND	ND	1.492	6.7	10	ND	ND	10
Iodomethane (Methyl Iodide)	ND	ND	1.637	3.054	5	ND	ND	5
Carbon Disulfide	ND	ND	1.657	3.02	5	ND	ND	5
Acetone	ND	ND	5.367	1.9	10	ND	ND	10
Toluene	0.11	5	1.053	4.57	5	5	ND	5
1,1,2-Trichloroethane	0.10	5	1.069	4.68	5	5	ND	5
Tetrachloroethene	0.14	5	1.089	4.59	5	5	ND	5
Dibromochloromethane	0.05	5	0.585	8.55	5	5	ND	5
1,2-Dibromomethane	0.06	5	0.932	5.36	5	5	ND	5
Chlorobenzene	0.04	5	0.856	5.84	5	5	ND	5
1,1,1,2-Tetrachloroethane	0.05	5	0.901	5.55	5	5	ND	5
Ethylbenzene	0.06	5	1.047	4.78	5	5	ND	5

TABLE 5-9
NORTH CANTON LABORATORY
Method 8260 Volatile Organics - 25 mL Purge
Method Detection Limits (MDL) and
Practical Quantitation Limits (PQL)[1]
(Continued)

Analyte	Method Water MDL[4,6] (μg/L)	Method Water EQL[5,6] (μg/L)	Water MDL[2] (μg/L)	PQL Factor	Water PQL[3] (RDL) (μg/L)	Method Soil EQL[5,6] (μg/Kg)	Soil MDL[2,6] (μg/Kg)	Soil RDL[7] μg/Kg
Total Xylene	ND	5	0.720	6.94	5	ND	ND	5
Styrene	0.04	5	0.681	7.34	5	5	ND	5
Bromoform	0.12	5	0.826	6.05	5	5	ND	5
1,1,2,2-Tetrachloroethane	0.04	5	1.608	3.11	5	5	ND	5
1,2,3-Trichloropropane	0.32	5	1.361	3.67	5	5	ND	5
1,4-Dichlorobenzene	0.03	5	1.02	4.902	5	5	ND	5
1,2-Dichlorobenzene	0.03	5	0.852	5.87	5	5	ND	5
1,2-Dibromo-3-chloropropane	0.26	5	2.563	1.951	5	5	ND	5
Acrylonitrile	ND	ND	2.833	17.65	50	ND	ND	50

Footnotes

(1) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(2) The Method Detection Limit study was performed according to specifications in 40 CFR Part 136 Appendix B.

(3) PQL = MDL X PQL Factor

(4) The method MDL is based is based on 25 ml sample volume.

(5) EQL = Estimated Quantitation Limit, for soils it is based on wet weight basis

(6) ND = Not Determined

(7) RDL = laboratory Reported Detection Limit

Facility Appendix

North Canton Laboratory

Section North Canton-6

Performance
Evaluation
Studies

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TABLE 6-1
NORTH CANTON LABORATORY
Performance Evaluation Sample Studies

PE Sample Program Description	Analysis Performed	Frequency of Participation
WP-EPA	Organics: BNA, Pest/PCB, VOA Inorganics: Metals and General Chemistry	2/year
WS-EPA	Organics: BNA, Pest/PCB, VOA Inorganics: Metals and General Chemistry	2/year
NY-ELAP	Potable: VOCs, BNA, Pest/PCB, Metals, General Chemistry Non-Potable: VOCs, BNAs, Pest/PCB, Metals and General Chemistry	1/year
Internal	Organics: VOA, BNA, Pest/PCB Inorganics: Metals and General Chemistry	QuartePQLy
Chemical Waste Management	Organics: Pest/PCB Inorganics: Metals and General Chemistry	QuartePQLy
West Virignia - APG/PET	Organics: VOA, BNA, Pest/PCB Inorganics: Metals and General Chemistry	1/Year
APG - Real WoPQLds (3M)	Organics: VOA, BNA, Pest/PCB Inorganics: Metals and General Chemistry	1/Year
State of Wisconsin	Organics: VOA, BNA, DROs, GROs Inorganics: Metals and General Chemistry	1/Year + Make-Up

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Facility Appendix

North Canton Laboratory

Section North Canton-7

Additional
Operation-Specific
Information

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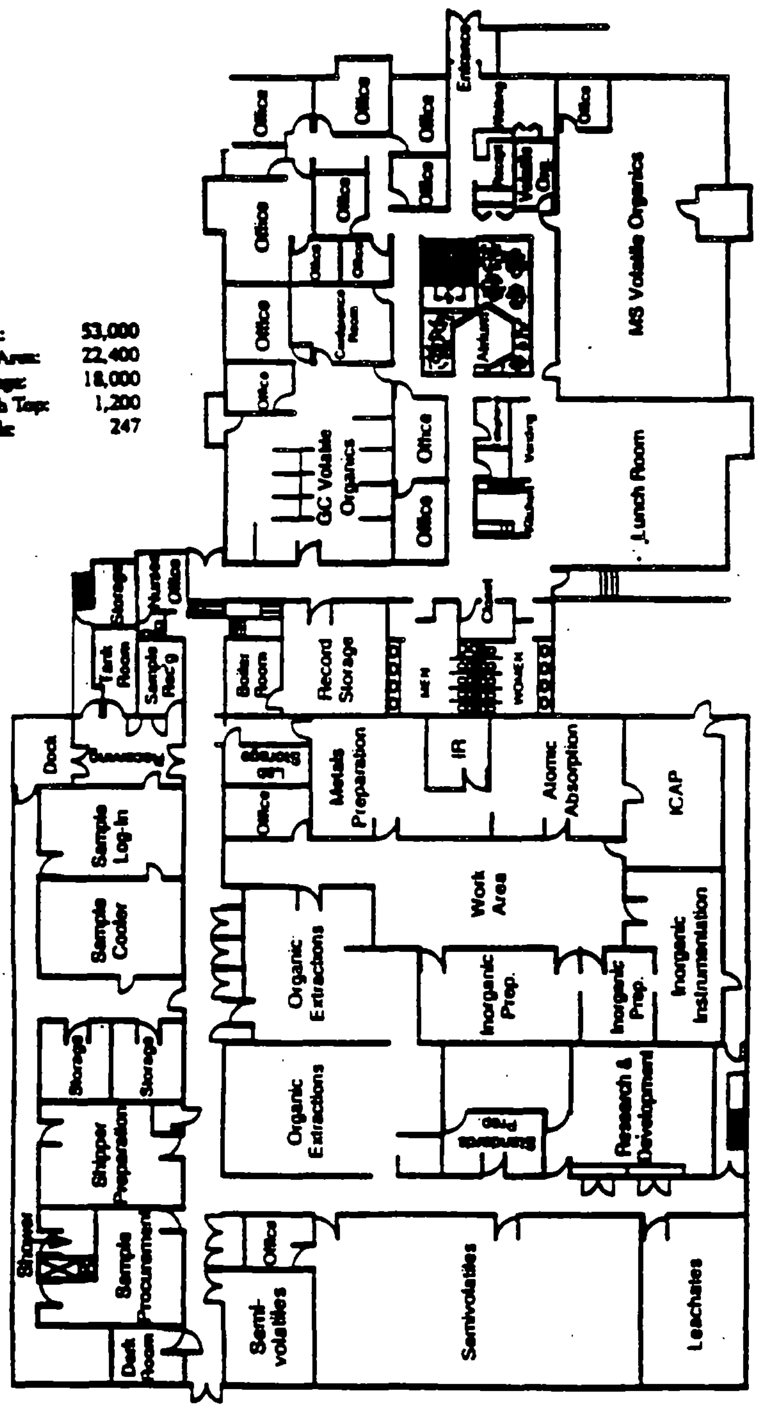
FIGURE 7-1

(Not to Scale)

Square Feet, Total:	53,000
Square Feet, Lab Area:	22,400
Square Feet, Storage:	18,000
Linear Feet, Bench Top:	1,200
Linear Feet, Hoods:	247



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QUALITY ASSURANCE MANAGEMENT PLAN
ST. LOUIS LABORATORY

Facility Appendix

Quality Assurance Management Plan
Quanterra Incorporated

St. Louis Laboratory

Approved by:

Margaret C. Winter

Margaret C. Winter
Quality Assurance Manager
St. Louis Laboratory

Margaret S. Sleevi

Margaret S. Sleevi
Director, Quality Assurance
East

Larry R. Taake

Larry R. Taake
Laboratory Director
St. Louis Laboratory

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Facility Appendix

St. Louis Laboratory

Section St. Louis-0

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Section St. Louis-1

Organizational
Chart

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QUANTERRA INCORPORATED
ST. LOUIS LABORATORY

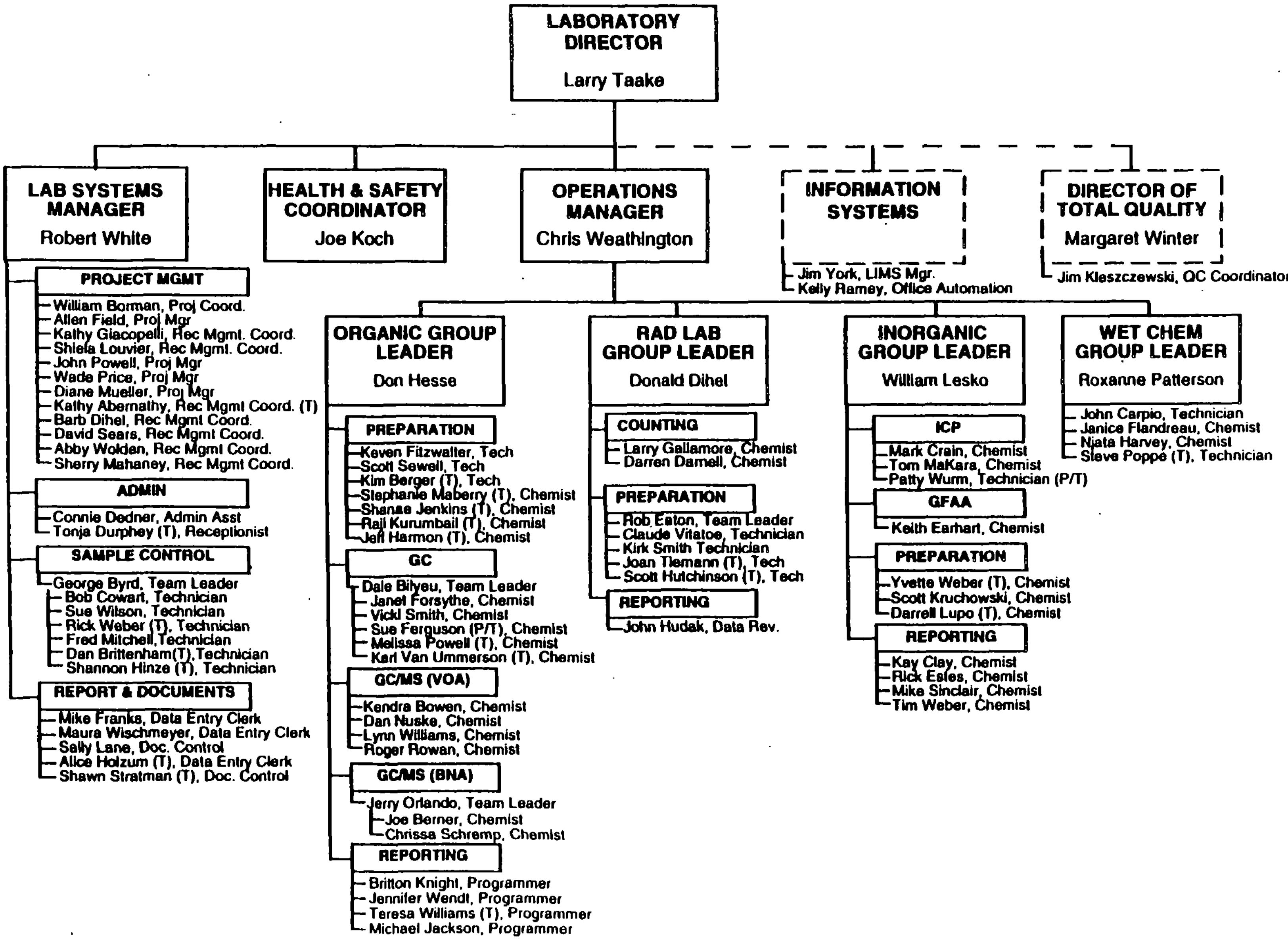

TABLE 1-1
ST. LOUIS LABORATORY
Key Personnel List

Position	Name	Degrees, Institutions, Year	Year Experience/ Environmental Laboratory	Years With Company	Years With Other Companies
Laboratory Director	Larry R. Taake	B.S. Zoology/ Wildlife Management, Southern Illinois University, 1978	14	4	10
Systems Manager	Robert E. White	B.S. Biology, Washington University, 1976 M.A. Business Administration, Webster University, 1985	21	4	17
Quality Assurance Manager/Technical Director	Margaret C. Winter	B.A., Chemistry, Oberlin College, 1957 M.A., Organic Chemistry, John Hopkins, 1959 Ph.D. Organic Chemistry, John Hopkins, 1963	19	4	15
Operations Manager	B. Chris Weathington	B.S., Chemistry, Auburn University, 1979 B.S., History, Auburn University, 1972	17	1	16
Health and Safety Officer/Rad Safety Officer	Joseph D. Koch	B.A. Liberal Arts, Cardinal Glennon, 1986 Ph.D., Occupational Safety and Health, University of Environmental Sciences, 1994	6	4	2
Organics Group Leader	Don G. Hesse	B.S., Chemistry, University of Missouri, 1984 Ph.D. Analytical Chemistry, University of Missouri, 1990	9	4	5
Wet Chemistry Group Leader	Roxanne Patterson		13	4	9
Radiochemistry Group Leader	Don Dihel	B.A Chemistry, Illinois State University, 1987	14	1	13
Metals Group Leader	Bill Lesko	B.S. Chemistry, University of Missouri, 1988 M.S. Chemistry, University of Missouri, 1993	8	Start date: 3/95	8
GC/MS Team Leader, Semivolatiles	Jerry Orlando	B.S. Chemistry, University of Missouri, 1982	13	4	9
GC Team Leader	Dale Bilyeu	B.S. Chemistry, Sangamon State University, 1984 A.S. Pre-Med, Springfield College, 1982	11	3	8

TABLE 1-1
ST. LOUIS LABORATORY
Key Personnel List
(Continued)

Position	Name	Degrees, Institutions, Year	Year Experience/ Environmental Laboratory	Years With Company	Years With Other Companies
Sample Control Team Leader	George Byrd	B.A. Business, Columbia College, 1990	.75	.75	0
Project Manager	Allen Field	B.S. Environmental Biology, Eastern Illinois University, 1982 M.S. Zoology, Eastern Illinois University, 1984 M.B.A., Eastern Illinois University, 1989	14	4	10
Project Manager	Diane Mueller	B.S. Botany and Zoology, Eastern Illinois University, 1978	15	.25	14.75
Project Manager	Wade Price	B.S. Chemistry/Physics, Pacific Lutheran University, 1985 M.B.A, Washington Univ 1991	5.5	1.25	4.25
Project Manager	John Powell	B.S. Chemistry, University of Missouri, 1986 M.S. Engineering and Policy, Washington University, 1993	7	4	3
Sample Control Team Leader (Second Shift)	Bob Cowart	A.S. Business, Jefferson College, 1978	13	4	9

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Facility Appendix

St. Louis Laboratory

Section St. Louis-2

Instrument
List

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TABLE 2-1
ST. LOUIS LABORATORY
Instrument List

Instrument Type	Manufacturer	Model	Age (years)	Autosampler
Gas Chromatograph/Mass Spectrometer RTE Data System and Library (Wiley/NBS) 9-track magnetic tape Autosampler	Hewlett Packard	5988A	5	Yes
Gas Chromatograph/Mass Spectrometer RTE Data System and Library (Wiley/NBS) 9-track magnetic tape Autosampler	Hewlett Packard	5988A	7	Yes
Gas Chromatograph/Mass Spectrometer RTE Data System and Library (Wiley/NBS) 9-track magnetic tape Autosampler	Hewlett Packard	5970	7	Yes
Gas Chromatograph/Mass Spectrometer RTE Data System and Library (Wiley/NBS) 9-track magnetic tape Autosampler	Hewlett Packard	5970	7	Yes
Gas Chromatograph/Mass Spectrometer RTE Data System and Library (Wiley/NBS) 9-track magnetic tape Autosampler	Hewlett Packard	5970	7	Yes
Gas Chromatograph/Mass Spectrometer RTE Data System and Library (Wiley/NBS) 9-track magnetic tape Autosampler	Hewlett Packard	5970	7	Yes
Gas Chromatograph/Mass Spectrometer RTE Data System and Library (Wiley/NBS) 9-track magnetic tape Autosampler	Hewlett Packard	5970	7	Yes
Purge and Trap ALS/Heated Purge	Tekmar	LSC2000	5	Yes
Purge and Trap ALS/Heated Purge	Tekmar	LSC2000	5	Yes
Purge and Trap ALS/Heated Purge	Tekmar	LSC3000	1.5	Yes
Purge and Trap ALS/Heated Purge	Tekmar	LSC3000	1.5	Yes
Purge and Trap ALS/Heated Purge	Tekmar	LSC2000	3.5	Yes

TABLE 2-1
ST. LOUIS LABORATORY
Instrument List
(Continued)

Instrument Type	Manufacturer	Model	Age (years)	Autosampler
Purge and Trap ALS/Heated Purge	Tekmar	LSC2000	7	Yes
Purge and Trap ALS/Heated Purge	Tekmar	LSC2000	7	Yes
Purge and Trap ALS/Heated Purge	Tekmar	LSC2000	7	Yes
Gas Chromatograph Capillary/Packed Column Autoinjector, Autosampler	Hewlett Packard	5890	7	Yes
Gas Chromatograph Capillary/Packed Column Autoinjector, Autosampler	Hewlett Packard	5890	7	Yes
Gas Chromatograph Capillary/Packed Column Autoinjector, Autosampler	Hewlett Packard	5890	7	Yes
Gas Chromatograph Capillary/Packed Column Autoinjector, Autosampler	Hewlett Packard	5890	7	Yes
Gas Chromatograph Capillary/Packed Column Autoinjector, Autosampler	Hewlett Packard	5890	7	Yes
Gas Chromatograph Capillary/Packed Column Autoinjector, Autosampler	Hewlett Packard	5890	7	Yes
Gas Chromatograph Capillary/Packed Column Autoinjector, Autosampler	Hewlett Packard	5890	7	Yes
Gas Chromatograph Capillary/Packed Column Autoinjector, Autosampler	Hewlett Packard	5880	7	Yes
Inductively-Coupled Argon Plasma Vacuum Spectrometer	Thermo Jarrell Ash	1100	7	Yes
Inductively-Coupled Argon Plasma Vacuum Spectrometer	Thermo Jarrell Ash	9000	5	Yes

TABLE 2-1
ST. LOUIS LABORATORY
Instrument List
(Continued)

Instrument Type	Manufacturer	Model	Age (years)	Autosampler
Inductively-Coupled Argon Plasma Vacuum Spectrometer	Thermo Jarrell Ash	61E	1	Yes
Atomic Absorption Spectrometer, Graphite Furnace	Perkin Elmer	5100Z-PC	3	Yes
Atomic Absorption Spectrometer, Graphite Furnace	Perkin Elmer	5100Z-PC	3	Yes
Atomic Absorption Spectrometer, Graphite Furnace/Flame	Perkin Elmer	5100Z-PC	3	Yes
Automated Mercury Analyzer	Leeman Labs	PS200	1	Yes
Atomic Absorption Spectrometer, Cold Vapor Assembly	Thermo Jarrell Ash	12E	7	No
Total Organic Carbon Analyzer	Dohrmann-Xertex	DC180	7	No
Total Organic Halogen Analyzer	Dohrmann-Xertex	DX20A	7	No
Ion Chromatograph HPLC Module	Dionex	4020i	7	Yes
High-Pressure Liquid Chromatograph	Perkin Elmer	410	7	Yes
High-Pressure Liquid Chromatograph	Perkin Elmer	410	7	Yes
High-Pressure Liquid Chromatograph	SSI	220B	4	Yes
High-Pressure Liquid Chromatograph	Hewlett-Packard	1090	6	Yes
UV Spectrophotometer	Milton Roy	601	7	No
Gel Permeation Chromatograph with UV Detector (GPC)	ABC Laboratories	1002A	6	Yes
Gel Permeation Chromatograph with UV Detector (GPC)	ABC Laboratories	1002B	6	Yes
Gel Permeation Chromatograph with UV Detector (GPC)	ABC Laboratories	1002B	6	Yes
IR Spectrophotometer, Ratio Recording	Perkin Elmer	1420	6	No
IR Spectrophotometer, Ratio Recording	Perkin Elmer	1420	8	No
Remote Microwave Digestion System	Floyd	RMS 150	3	No

TABLE 2-1
ST. LOUIS LABORATORY
Instrument List
(Continued)

Instrument Type	Manufacturer	Model	Age (years)	Autosampler
Gas Proportional Counter, Low Background, 16 Detectors	Tennelec	LB4000	6	No
Gas Proportional Counter, Low Background, 16 Detectors	Tennelec	LB4100 (Red)	1	No
Gas Proportional Counter, Low Background, 12 Detectors	Tennelec	LB4100 (Blue)	1	No
Gamma Spectrometer, Intrinsic Germanium Detectors	Princeton	Multi-component system	6	No
Gamma Spectrometer, Intrinsic Germanium Detectors	Tennelec/Ortec	Multi-component system	6	No
Gamma Spectrometer, Intrinsic Germanium Detectors	Tennelec/Ortec	Multi-component system	6	No
Gamma Spectrometer, Intrinsic Germanium Detectors	Tennelec/Ortec	Multi-component system	6	No
Gamma Spectrometer, Intrinsic Germanium Detectors	Tennelec/Ortec	Multi-component system	6	No
Gamma Spectrometer, Intrinsic Germanium Detectors	Tennelec/Ortec	Multi-component system	6	No
Gamma Spectrometer, Intrinsic Germanium Detectors	Tennelec/Ortec	Multi-component system	6	No
Gamma Spectrometer, Intrinsic Germanium Detectors	Canberra	Multi-component system	6	No
Kinetic Phosphorescence Analyzer (KPA)	Chemchek	Multi-component system	5	No
Kinetic Phosphorescence Analyzer (KPA)	Chemchek	Multi-component system	7	No
Scintillation Detector	Randam	SC-5	3	No
Scintillation Detector	Randam	SC-5	3	No
Scintillation Detector	Randam	SC-5	3	No
Scintillation Detector	Randam	SC-5	3	No
Liquid Scintillation Detector	Packard	2200CA	9	No
Liquid Scintillation Detector	Packard	2200CA	9	No

TABLE 2-1
ST. LOUIS LABORATORY
Instrument List
(Continued)

Instrument Type	Manufacturer	Model	Age (years)	Autosampler
Alpha Spectrometer Counting System (48 detectors)	EG&G Ortec/Canberra	Multi-component system	2	No
Auto Analyzer	Technicon	Traacs 800	6	Yes

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Facility Appendix

St. Louis Laboratory

Section St. Louis-3

Standard
Operating
Procedures

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TABLE 3-1
ST. LOUIS LABORATORY
Standard Operating Procedures (SOPs) List

SOP No.	Rev. No.	Rev. Date	Sop Title
0001	2.0	1/21/93	Standards Preparation
1001	1.0	2/17/94	Thermometer Calibration
1002	0	4/10/91	Automatic Pipetter Calibration
1003	0	4/11/91	Balance Calibration and the Use of Class S Weights
2001	1.0	8/2/93	Sample Receipt and Chain of Custody
2003	0	11/20/92	Release of Samples for Analysis Prior to Complete Login
2004	1.0	9/30/93	Preparation of Sample Containers
3001	1.0	12/16/92	Cyanide Distillation
IP-0003	0	9/20/93	Acid Digestion of Waters for Total Recoverable or Dissolved Metals for Analysis by FLAA or ICAP
IP-0006	0	3/4/94	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICAP
IP-0004	0	9/16/93	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by Graphite Furnace
IP-0005	0	9/16/93	Acid Digestion of Sediments, Sludges and Soils
IP-0001	0	8/30/93	Water Preparation Metals for CLP
IP-0002	0	8/30/93	Soil Preparation Metals for CLP
3008	1.0	5/7/92	Distillation of Phenols
3009	0	2/20/94	Microwave Digestion by SW-846 3015/3051
4001	0	1/3/91	Total Coliform
4002	0	1/3/91	Fecal Coliform
4003	0	1/3/91	Turbidity
4004	1.0	12/18/92	Cyanide Analysis of the Technicon TRAACS 800 Autoanalyzer
4005	0	6/11/91	Percent Solids Determination
4006	1.0	5/10/93	Extraction and Analysis of Chlorinated Herbicides (Method 8150)
4007	0	7/1/91	The Analysis of 2,3,7,8-Tetrachlorinated Dibenzo-p-Dioxin
4008	0	1/21/91	Hardness
4009	0	1/21/91	Chemical Oxygen Demand (COD)
4011	1.0	8/5/91	The Analysis of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans
4012	1.0	1/6/94	Total Dissolved Solids Dried at 180°C (Filterable Residue)
4013	0	1/21/91	Total Solids Dried at 103-105°C (Non-Filterable Residue)
4014	1.0	1/6/94	Total Suspended Solids Dried at 103-105°C (Non-Filterable Residue)

TABLE 3-1
ST. LOUIS LABORATORY
Standard Operating Procedures (SOPs) List
(Continued)

SOP No.	Rev. No.	Rev. Date	Sop Title
4015	1.0	6/22/92	Oil and Grease (Partition-Gravimetric Method)
4018	1.0	6/11/93	Total Organic Halides (TOX)
4019	0	1/23/91	Analysis of pH in Water
4020	1.0	6/10/92	Analysis of Sulfide in Water
4024	1.0	6/12/92	Phosphorus, All Forms
4025	1.0	6/12/92	Analysis of Ammonia as Nitrogen
4026	0	1/24/91	Biochemical Oxygen Demand (BOD)
4027	1.0	12/9/92	Total Organic Carbon
4028	1.0	12/30/93	Phenolics, Total Recoverable
4029	0	12/20/93	Acidity of Water and Waste Water
4030	1.0	5/31/94	Alkalinity of Water and Waste Water
4031	0	1/25/91	Total Kjeldahl Nitrogen in Water and Waste Water
4032	0	4/8/91	The Analysis of Tetrachlorinated Dibenzo-P-Dioxins
4033	1.0	4/25/94	Analysis of pH in Soil
4034	0	9/3/91	Total Petroleum Hydrocarbons (TPH) by IR
4035	0	10/29/91	Nitrate/Nitrite Analysis by TRAACS 800 (Hydrazine Reduction)
4036	0	6/22/92	Fluoride (Potentiometric, Ion Selective Electrode)
4037	0	6/8/92	Conductivity in Water
4039	0	6/8/92	Flash Point by Pensky-Martins Closed Cup Tester
4040	0	5/4/92	Oil & Grease Recovery from Solids by Soxhlet Extraction
4041	0	6/9/93	Analysis of Anions by Ion Chromatography (Method 300.0)
4043	0	12/10/92	The Analysis of Volatile Organics by Gas Chromatography/Mass Spectroscopy, USEPA CLP, 2/88, Scope of Work
4045	0	8/12/92	Extraction and Analysis of Chlorinated Herbicides by EPA Method 615
4046	0	12/11/92	Headspace Analysis of Volatile Organics; Screening Method for Estimation of Concentration
4047	0	12/10/92	GC Analysis of Organochlorine Pesticides and PCBs by SW-846 Method 8080
4048	0	12/15/92	Extraction of Organophosphorus Pesticides
4049	0	12/15/92	GC Analysis of Organophosphorus Pesticides by SW-846 Method 8141

TABLE 3-1
ST. LOUIS LABORATORY
Standard Operating Procedures (SOPs) List
(Continued)

SOP No.	Rev. No.	Rev. Date	Sop Title
4050	0	12/10/92	The Analysis of Volatile Organics by Gas Chromatography/Mass Spectroscopy, USEPA CLP, 3/90, Scope of Work
MT-0001	0	9/2/93	CLP GFAA Analysis
4052	0	1/28/93	CLP ICP Analysis
4053	1.0	1/29/94	Extraction and Analysis of Semivolatile Organics by CLP 3/90
CO-0001	0	9/1/93	Pesticide/PCBs by CLP 3/90
4055	0	2/21/93	Extractable Total Petroleum Hydrocarbons (TPH) by GC
4056	0	3/10/93	HPLC Analysis of Polynuclear Aromatic Hydrocarbons
4057	0	1/28/94	CLP FAA Analysis
4058	0	3/31/93	Nitroaromatics and Nitramines (Explosives) by HPLC (Modified 8330)
4059	0	5/10/93	Analysis of Volatile Organics by Gas Chromatography/Mass Spectrometry, Method 8240
4060	0	6/9/93	Extraction of PCB's in Oil Samples
4061	0	7/6/93	Residual Chlorine
4062	0	11/1/93	Aromatic Volatile Organics by Method 8020
4063	0	8/16/93	CLP Mercury Analysis in Water and Soil/Sediment by Manual CVAA
4064	0	9/20/93	Analysis of Volatile Organics by Method 624
4065	0	10/6/93	TCLP Leaching Procedure (Method 1311)
4066	0	10/6/93	California Wet Leaching Procedure for Metals
MT-0006	0	3/14/94	ICAP Analysis by Method 6010A
MT-0005	0	9/18/93	Graphite Furnace Metals by EPA and SW-846 (non-CLP)
4070	0	1/26/94	Mercury Analysis by CVAA, non-CLP (7470A and 245.1)
4071	0	1/1/94	Semivolatile Organic Analysis by 8270A
4072	0	1/24/94	Extraction and Analysis of Dioxins and Furans by CLP 10/90
4073	0	1/29/94	GC/FID Analysis of Acrolein and Acrylonitrile by 8030A
4077	0	11/24/93	Dissolved Silica
4078	0	1/29/94	GC/FID Analysis of Acrolein and Acrylonitrile by 603
4079	0	1/1/94	Chlorinated Pesticides/PCBs by EPA Method 608
4080	0	1/18/94	Semivolatile Organic Analysis by Method 625
4086	0	1/26/94	Mercury Analysis of Solid or Semisolid Waste by Method 7471A, CVAA
4087	0	12/8/93	Paint Filter Liquids Test
4088	0	1/26/94	Boron by Method 212.3, Spectrophotometric

TABLE 3-1
ST. LOUIS LABORATORY
Standard Operating Procedures (SOPs) List
(Continued)

SOP No.	Rev. No.	Rev. Date	Sop Title
4089	0	1/20/94	Low Boiling Hydrocarbons (LBH) by 8015A or California LUFT
4090	0	1/29/94	GC/FID Analyis of Nonhalogenated Volatile Organics by Method 8015A
4091	0	1/20/94	GC/FID Screening of Extracts for SVOA Analysis
4092	0	2/12/94	Extraction and Analysis of Phenols by SW846-8040A
4093	0	2/12/94	Extraction and Analysis of Phthalate Esters by SW-846 8060
4094	0	3/30/94	Extraction and Analysis of Nitroaromatic and Nitramine Explosives by GC/ECD
4095	0	6/15/94	GC/MS Analysis of Volatile Organics by SW-846 8260
4096	0	9/1/94	Sumazine Analysis by GC/ECD
5001	1.0	1/21/93	Data Reports
5002	0	7/6/93	Data Packaging
5003	0	7/29/93	General Procedure for the Creation of Electronic Data Files
5005	0	6/17/94	Backup of Laboratory Information Management System
QC-0003	0	6/3/93	Data Review
6001	1.0	7/15/93	Data Review and Verification
7001	0	4/22/91	Material Procurement and Control
7002	0	6/4/91	Personnel Training and Evaluation
STL-QA-0001	0	10/7/94	Software Development
QC-0004	0	11/10/93	Laboratory Control Samples
7005	0	7/3/91	Evaluation of Analytical Accuracy & Precision through the use of Quality Control Charts
7006	0	6/30/91	Quality Assurance Summary
7007	0	6/29/91	IDL/MDL Determination
QC-0005	0	9/30/93	Client-Specific QC Batches
7008	0	7/1/91	QC Sample Tracking
7009	0	7/8/91	Quality and Operation Records Maintenance
7010	0	5/4/92	Autolab Sample Loading Verification
7011	1.0	9/27/93	Laboratory Logbook Control and Maintenance
7012	0	7/16/93	Internal Surveillances
QC-0007	0	4/8/94	Time and Data Integrity
8001	0	4/10/91	Off-Site Storage of Documentation
8002	0	6/28/91	Project Records and Document Control

TABLE 3-1
ST. LOUIS LABORATORY
Standard Operating Procedures (SOPs) List
(Continued)

SOP No.	Rev. No.	Rev. Date	Sop Title
9001	0	6/24/91	Preventive Maintenance
10001	0	1/2/91	Glassware Preparation for Organic and Dioxin Analyses
10002	1.0	6/10/92	Glassware Preparation for Inorganic and Trace Metal Analyses
10003	1.0	9/13/93	Temperature Monitoring
10004	0	6/5/91	Nonconformance and Corrective Action
10005	0	5/17/91	Preparation of PUF Plugs Prior to Air Sample Collection
10006	1.0	9/17/93	Water Monitoring
10007	0	6/8/92	Glassware Preparation for Radiochemistry and Radiological Screening Analyses
10008	0	10/8/91	Laboratory Security Systems
10009	0	1/10/92	Standard Operating Procedure Development and Control
10010	0	6/8/92	Preparation of Stainless Steel Planchet for Radiochemistry Analyses
10011	0	10/22/93	Preventing Sample Contamination
10012	0	11/3/93	VOA Holding Blank Analysis
12060	0	7/9/91	Monitoring Air Flow Rates
12310	0	5/4/93	Radiation Protection Program
12313	0	12/20/91	Maintenance of Radiation Protection Records
12317	0	12/20/91	The ALARA Program
12323	0	12/20/91	Radiation Safety Training
12340	3.0	12/20/91	Dosimeter Program for Personnel and Area Monitoring
12350	3.0	12/20/91	Area Surveys and Radiation Monitoring
12352	0	12/20/91	Personnel Monitoring for Radioactive Contamination
12353	1.0	12/20/91	Radiation Work Permits
12380	2.0	12/20/91	Packaging and Storage of Radioactive Waste
12390	2.0	12/20/91	Emergencies Involving Radioactive Waste
12400	3.0	12/20/91	Personnel Decontamination
12410	2.0	12/20/91	Equipment and Area Decontamination
12420	2.0	12/20/91	Accountability of Licensed Radioactive Material
12430	2.0	12/20/91	Requisition of Licensed Materials
12440	2.0	12/20/91	Calibration and Maintenance of Radiation Survey Instruments
12450	4.0	9/23/93	Surveying Radioactive Material Shipments

TABLE 3-1
ST. LOUIS LABORATORY
Standard Operating Procedures (SOPs) List
(Continued)

SOP No.	Rev. No.	Rev. Date	Sop Title
12452	0	12/20/91	Receiving Packages with Greater than Type A Quantities of Radioactive Material
12460	3.0	10/7/93	Packaging and Transportation of Radioactive Materials
12470	0	3/7/94	Monitoring Effluents for Radioactive Material
12501	1.0	5/13/93	Hazardous Waste Management Program
12502	4.0	5/27/93	Collection & Accumulation of Hazardous Waste
12503	2.0	5/19/92	Disposal of Samples After Analysis
12504	1.0	6/30/92	Hazardous Waste Sampling & Disposal
12505	2.0	11/7/91	Guidelines for Disposal to Sewer
12506	0	3/21/91	Hazardous Waste Manifesting
12507	0	3/25/91	Safety Inspection of Storage Room
12508	2.0	6/29/92	Reporting to Regulatory Agencies
12509	0	3/26/91	Hazardous Waste Spill Response
12550	0	8/8/91	Treatability Studies for Waste Solidification
12710	1.0	2/16/93	Return of Samples to Client
12801	2.0	8/13/93	Contingency Plan
12950	0	8/14/92	Lock Out/Tag Out of Hazardous Energy Sources
13001	0	1/21/91	Actinium 228 in Soil, Water and Other Media
13002	2.0	7/2/93	Gross Alpha/Beta
13003	1.0	1/22/93	Total Alpha Emitting Isotopes of Radium
13004	0	1/22/93	Preparation of Strontium 89 and 90
13005	1.0	11/12/92	Tritium in Water or other Fluids
13006	1.0	10/6/92	Preparation of Soil, Sludge and Filter Paper Samples for Radiochemical Analysis
13007	1.0	6/28/93	Sequential Determination of Isotopic Plutonium, Thorium and Uranium
13010	1.0	1/25/93	Radium 228 in Water
13012	0	9/4/91	Evaluation of the Sample Transmission Factor
13013	1.0	1/25/93	Operation and Calibration of the Alpha Spectrometer
13014	1.0	5/1/92	Calibration of Princeton Gamma Tech Intrinsic Germanium Gamma Spectrometer
13015	2.0	1/22/93	Screening Samples for the Presence of Radioactive Material

TABLE 3-1
ST. LOUIS LABORATORY
Standard Operating Procedures (SOPs) List
(Continued)

SOP No.	Rev. No.	Rev. Date	Sop Title
13016	0	6/26/91	Classifying Radioactive Samples
13017	0	5/1/92	Daily Calibration Verification and Maintenance of the Germanium Spectroscopy System
13018	0	12/29/92	Operation of the Germanium Spectroscopy System
13019	0	1/22/93	Calibration of the Low Background Gas Flow Proportional Counting System
13020	0	5/22/92	Daily Calibration Verification and Maintenance of the Low Background Gas Flow Proportional Counting System
13021	0	5/8/92	Operation of the Low Background Gas Flow Proportional Counting System
13022	0	11/13/92	Analysis of Total Uranium by Laser Induced Phosphorimetry
13023	0	11/2/92	Operation and Calibration of a Liquid Scintillation Counter
13026	0	11/13/92	Radiochemical Determination of Tritium in Soil, Vegetation and Other Biological Samples - Azeotropic Method
13027	1.0	6/18/93	Gross Alpha Radiation in Water Using Coprecipitation
13028	0	1/25/93	Preparation and Dissolution of Sediment and Soil by Microwave Digestion
13029	0	1/21/93	Drying and Grinding of Soil and Solid Samples
13030	0	1/21/93	Preparation of Samples for Gamma Spectroscopy
13031	0	1/21/93	Preparation of Vegetation and Tissue Samples
13032	0	1/21/93	Radium 226 and Radon 222 by Radon Emanation
13033	0	1/25/93	Determination of Plutonium and/or Americium in Small Soil and Fresh Water Sediment Samples
13036	0	10/14/93	Polonium in Water, Vegetation, Soil and Air Filters
13037	0	10/1/93	Determination of Lead-210 in Water and Solid Samples
13038	0	8/12/94	Electrodeposition of Actinides
13039	0	8/26/94	Determination of Technetium-99
13040	0	9/30/94	Gross Gamma Screening for Environmental Matrices

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Facility Appendix

St. Louis Laboratory

Section St. Louis-4

Analytical
Methods

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TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Acidity	Water	Method 305.1	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Alkalinity	Water	Method 310.1	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 310.1 (modified)	Not Applicable	Not Applicable	Not Applicable
Ammonia	Water	Method 350.1	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 350.1 (modified)	Not Applicable	Not Applicable	Not Applicable
Boron	Water	Method 212.3[(1)]	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods: NPDES	Methods: RCRA (SW846)	Methods: CLP	Methods: Other
Boron (continued)	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Bromide	Water	Method 300.0	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Chloride	Water	Method 300.0(1)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 300.0 (modified)	Not Applicable	Not Applicable	Not Applicable
Conductivity	Water	Method 120.1	Method 9050	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Conductivity (continued)	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Cyanide (Amenable)	Water	Method 335.1	Method 9010	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 9010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Cyanide (Free)	Water	Not Applicable	Not Applicable	Not Applicable	Standard Methods 412 H
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLPLeachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Standard Methods 412 H
Cyanide (Total)	Water	Method 335.2(2)	Method 9010	Method is CLP (335.2 CLP-M)	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 1311 to obtain leachate Method 9010 for Leachate	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Cyanide (Total) (continued)	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 9010 (Applicable to soils that give suspensions in water only)	Method is CLP	Not Applicable
Dissolved Organic Carbon (DOC)	Water	Method 415.1(3)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Dissolved Silica	Water	Method 370.1(2)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Flashpoint	Water	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 1010	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods: NPDES	Methods: RCRA (SW846)	Methods: CLP	Methods: Other
Flashpoint (continued)	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 1010 (Modified)	Not Applicable	Not Applicable
Fluoride	Water	Method 300.0(1) Method 340.2(2)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 300.0 (modified)	Not Applicable	Not Applicable	Not Applicable
Hardness	Water	Method 130.2(2)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Nitrite (NO_2)	Water	Method 300.0(1) (non-preserved) Method 353.1(2) (preserved)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Nitrite (NO_2) (continued)	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 300.0 Method 353.1 (modified)	Not Applicable	Not Applicable	Not Applicable
Nitrate (NO_3)	Water	Method 300.0(1) (non-preserved) Method 353.1(2) (preserved)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 300.0 Method 353.1 (modified)	Not Applicable	Not Applicable	Not Applicable
Nitrate plus Nitrite	Water	Method 353.1(3)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Oil and Grease	Water	Method 413.1(2)	Method 9070	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 9071	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 9071	Not Applicable	Not Applicable
Paint Filter	Water	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 9095	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 9095	Not Applicable	Not Applicable
pH	Water	Method 150.1	Method 9040	Method CLP	Not Applicable
	Liquid	Not Applicable	Method 9040	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 9040	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 9045	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 9045	Method CLP	Not Applicable
Phenols (Total)	Water	Method 420.2(2)	Method 9066(2)	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Phenols (Total) (continued)	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Phosphate (Total)	Water	Method 365.1$^{(2)}$	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 365.1 (modified)	Not Applicable	Not Applicable	Not Applicable
Phosphorus (Total)	Water	Method 365.1$^{(2)}$	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 365.1 (modified)	Not Applicable	Not Applicable	Not Applicable
Reactivity	Water	Not Applicable	Section 7.3	Not Applicable	Not Applicable
	Liquid	Not Applicable	Section 7.3	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Section 7.3	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Reactivity (continued)	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Section 7.3	Not Applicable	Not Applicable
	Soil	NA	Section 7.3	Not Applicable	Not Applicable
Residual Chlorine	Water	Method 330.1	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Dissolved Silica	Water	Method 370.1[1]	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Sulfate (SO_4)	Water	Method 300.0[1]	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Sulfate (SO_4) (continued)	Soil	Method 300.0 (modified)	Not Applicable	Not Applicable	Not Applicable
Sulfide (SO)	Water	Method 376.1(2)	Method 9030(4)	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 9030	Not Applicable	Not Applicable
Sulfite (SO_3)	Water	Method 377.1(5)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 377.1 (modified)	Not Applicable	Not Applicable	Not Applicable
Total Organic Carbon (TOC)	Water	Method 415.1(2)	Method 9060(2)	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 9060	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Total Organic Halides (TOX)	Water	Method 450.1(2)	Method 9020(6)	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 9020	Not Applicable	Not Applicable
Total Petroleum Hydrocarbons by IR	Water	Method 418.1	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 418.1	Not Applicable	Not Applicable	Method 418.1-M
Total Solids	Water	Method 160.3(2)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Total Dissolved Solids	Water	Method 160.1(2)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Total Dissolved Solids (continued)	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Total Suspended Solids	Water	Method 160.2(2)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Total Kjeldahl Nitrogen (TKN)	Water	Method 351.2	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Method 351.2	Not Applicable	Not Applicable	Not Applicable
Turbidity	Water	Method 180.1(4)	Not Applicable	Not Applicable	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable

TABLE 4-1
ST. LOUIS LABORATORY
Wet Chemistry Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Turbidity (continued)	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Soil	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Footnotes

(1) Includes drinking water, surface water and mixed (aqueous) industrial waste effluents.

(2) Includes drinking, surface and saline waters, aqueous domestic and industrial waste.

(3) Includes drinking and other waters wherein the carbonaceous matter is either soluble or has a particle size of 0.2 mm or less. Homogenizing a sample to reduce the particle size may cause loss of purgeable organic carbon, thus yielding erroneously low results.

(4) Includes drinking, surface and saline waters.

(5) Includes drinking and surface waters, sewage and aqueous industrial waste.

(6) Includes drinking and ground waters.

TABLE 4-2
ST. LOUIS LABORATORY
Metals Sample Preparation Methods

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Toxicity Characteristic Leaching Procedure (TCLP)	Water	Not Applicable	Method 1311	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 1311	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 1311	Not Applicable	40 CFR Part 268
	Soil	Not Applicable	Method 1311	Not Applicable	40 CFR Part 268
ICAP Metals	Water	Method 200.7	Method 3005 Method 3010	Method CLP ILMO3.0	Not Applicable
	Liquid	Not Applicable	Method 3040	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 3010	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Proper pretreatment is described in Section 9 of Method 200.7	Method 3050	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3050	Method CLP ILMO3.0	Not Applicable
CVAA Mercury	Water	Method 245.1	Method 7470	Method CLP ILMO3.0	Not Applicable.
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Extract	Not Applicable	Method 7470	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Method 7471	Not Applicable	Not Applicable
	Soil	Method 245.5	Method 7471	Method CLP ILMO3.0	Not Applicable

TABLE 4-2
ST. LOUIS LABORATORY
Metals Sample Preparation Methods
(Continued)

Analytical Parameter	Matrix	Methods: NPDES	RCRA (SW846)	CLP	Other
Flame AA Metals	Water	Method 200.0	Element Method Potassium 3005/3010	Element Method Potassium CLP SOW	Not Applicable
	Liquid	Not Applicable	Element Method Potassium 3040	Not Applicable	Not Applicable
	TCLP Extract	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment	Not Applicable	Element Method Potassium 3050	Not Applicable	Not Applicable
	Soil	Not Applicable	Element Method Potassium 3050	Element Method Potassium CLP SOW	Not Applicable
GFAA Metals	Water	Method 200.0	Element Method Arsenic 3050/7060 Antimony 7041 Lead 3020 Selenium 3050/7740 Silver 7761 Thallium 3050/7841	Method CLP ILMO3.0	Not Applicable
	Liquid	Not Applicable	Method 3020	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 3020	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solid, Sediment		Element Method Arsenic 3050/7060 Antimony 7041 Lead 3050 Selenium 3050/7740 Silver 7761 Thallium 3050/7841	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3050	Method CLP ILMO3.0	Not Applicable
Volatiles by GC/MS	Water	Method 624	Method 5030 Method 8240	Method CLP OLMO1.8 OLMO3.1	Not Applicable
	Liquid	Not Applicable	Method 5030 Method 8240	Not Applicable	Not Applicable

TABLE 4-3
ST. LOUIS LABORATORY
Organic Sample Preparation Methods

Analytical Parameter	Matrix	Methods: NPDES	RCRA (SW846)	CLP	Other
Volatiles by GC/MS (continued)	TCLP Leachate	Not Applicable	Method 5030 Method 8240	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 5030 Method 8240	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 5030 Method 8240	Method CLP OLMO1.8 OLMO3.1	Not Applicable
Aromatic Volatiles by GC	Water	Method 602	Method 5030	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 5030	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 5030	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 5030	Not Applicable	Not Applicable
Non-Halogented Volatiles and Low Boiling Hydro-carbons by GC	Water	Method 603	Method 5030	Not Applicable	California LUFT
	Liquid	Not Applicable	Method 5030	Not Applicable	California LUFT
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 5030	Not Applicable	California LUFT
	Soil	Not Applicable	Method 5030	Not Applicable	California LUFT
Organochlorine Pesticides/ PCBs by GC	Water	Method 608	Method 3510	Method CLP OLMO1.8 OLMO3.1	Not Applicable
	Liquid	Not Applicable	Method 3580	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 3510	Not Applicable	Not Applicable

TABLE 4-3
ST. LOUIS LABORATORY
Organic Sample Preparation Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Organochlorine Pesticides/ PCBs by GC (continued)	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 3550	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3550	Method CLP OLMO1.8 OLMO3.1	Not Applicable
Organo-phosphorus Pesticides by GC	Water	Not Applicable	Method 3510	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 3580	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 3510	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 3550	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3550	Not Applicable	Not Applicable
Nitroaromatics by GC	Water	Not Applicable	Not Applicable	Not Applicable	Quanterra St. Louis Developed Method SOP SL4094
	Liquid	Not Applicable	Not Applicable	Not Applicable	Quanterra St. Louis Developed Method SOP SL4094
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Not Applicable	Not Applicable	Quanterra St. Louis Developed Method SOP SL4094
	Soil	Not Applicable	Not Applicable	Not Applicable	Quanterra St. Louis Developed Method SOP SL4094

TABLE 4-3
ST. LOUIS LABORATORY
Organic Sample Preparation Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Total Petroleum Hydrocarbons by GC	Water	Not Applicable	Method 3510	Not Applicable	California LUFT
	Liquid	Not Applicable	Method 3580	Not Applicable	California LUFT
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 3550	Not Applicable	California LUFT
	Soil	Not Applicable	Method 3550	Not Applicable	California LUFT
Herbicides by GC	Water	Method 615	Method 8150	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 8150	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8150	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8150	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8150	Not Applicable	Not Applicable
Semivolatiles by GC and GC/MS	Water	Method 625	Method 3510, 3520	CLP OLM01.8 OLMO3.1	Not Applicable
	Liquid	Not Applicable	Method 3580	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 3510	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 3580, 3550	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 3550	CLP OLM01.8 OLMO3.1	Not Applicable

TABLE 4-4
ST. LOUIS LABORATORY
Flame Atomic Absorption Inorganic Methods

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Flame AA Metals Potassium Cesium	Water	Element Method Potassium 258.1	Element Method Potassium 7610	Element Method Potassium 258.1/CLP-M	Cesium by SL4057
	Liquid	Not Applicable	Element Method Potassium 7610	Not Applicable	Cesium by SL4057
	TCLP Extract	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Element Method Potassium 7610	Not Applicable	Cesium by SL4057
	Soil	Not Applicable	Element Method Potassium 7610	Element Method Potassium 258.1M	Cesium by SL4057

TABLE 4-5
ST. LOUIS LABORATORY
Graphite Furnace Atomic Absorption Methods

Analytical Parameter	**Matrix**	**Methods**			
		NPDES	**RCRA (SW846)**	**CLP**	**Other**
Antimony	Water	Method 204.2[1]	Method 7041	CLP Method 204.2-M	Not Applicable
	Liquid	Not Applicable	Method 7041	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7041	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 204.2 **Requires proper pretreatment.**	Method 7041	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7041	CLP Method 204.2-M	Not Applicable
Arsenic	Water	Method 206.2[1]	Method 7060	CLP Method 206.2-M	Not Applicable
	Liquid	Not Applicable	Method 7060	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7060	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 206.2 **Requires proper pretreatment**	Method 7060	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7060	CLP Method 206.2-M	Not Applicable
Cadmium	Water	Method 213.2[1]	Method 7131	CLP Method 213.2-M	Not Applicable
	Liquid	Not Applicable	Method 7131	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7131	Not Applicable	Not Applicable

TABLE 4-5
ST. LOUIS LABORATORY
Graphite Furnace Atomic Absorption Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Cadmium (continued)	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 213.2 **Requires proper pretreatment**	Method 7131	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7131	CLP Method 213.2-M	Not Applicable
Lead	Water	Method 239.2$^{(1)}$	Method 7421	CLP Method 239.2-M	Not Applicable
	Liquid	Not Applicable	Method 7421	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7421	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 239.2 **Requires proper pretreatment**	Method 7421	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7421	CLP Method 239.2-M	Not Applicable
Selenium	Water	Method 270.2	Method 7740	CLP Method 270.2-M	Not Applicable
	Liquid	Not Applicable	Method 7740	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7740	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 270.2 **Requires proper pretreatment**	Method 7740	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7740	CLP Method 270.2-M	Not Applicable

TABLE 4-5
ST. LOUIS LABORATORY
Graphite Furnace Atomic Absorption Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Silver	Water	Method 272.2	Method 7761	CLP Method 272.2-M	Not Applicable
	Liquid	Not Applicable	Method 7761	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7761	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Method 272.2 **Requires proper pretreatment**	Method 7761	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7761	CLP Method 272.2-M	Not Applicable
Thallium	Water	Method 279.2	Method 7841	CLP Method 279.2-M	Not Applicable
	Liquid	Not Applicable	Method 7841	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 7841	Not Applicable	Not Applicable
	Domestic Waste, IndustrialWaste, Sludge, Solids, Sediment	Method 279.2 **Requires proper pretreatment**	Method 7841	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 7841	CLP Method 279.2-M	Not Applicable

Footnotes

(1) Includes drinking, surface and saline waters.

TABLE 4-6
ST. LOUIS LABORATORY
Cold Vapor Atomic Absorption Methods

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
CVAA Mercury	Water	Method 245.1	Method 7470	CLP Method 245.1-M	Not Applicable
	Liquid	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	TCLP Extract	Not Applicable	Method 7470	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 7471	Not Applicable	Not Applicable
	Soil	Method 245.5	Method 7471	CLP Method 245.1-M	Not Applicable

TABLE 4-7
ST. LOUIS LABORATORY
Organic Methods

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Volatiles by GC/MS	Water	Method 624	Method 8240 Method 8260	Method CLP OLMO1.8	Not Applicable
	Liquid	Not Applicable	Method 8240	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8240	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8240	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8240 Method 8260	Method CLP OLMO1.8	Not Applicable
Aromatic Volatiles by GC	Water	Method 602	Method 8020	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 8020	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8020	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8020	Not Applicable	Not Applicable
Non-Halogenated Volatiles by GC; Acrolein and Acrylonitrile	Water	Method 603	Method 8015 Method 8030	Not Applicable	HBH Method 8015M California LUFT
	Liquid	Not Applicable	Method 8015 Method 8030	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8015 Method 8030	Not Applicable	HBH Method 8015M California LUFT
	Soil	Not Applicable	Method 8015 Method 8030	Not Applicable	HBH Method 8015M California LUFT

TABLE 4-7
ST. LOUIS LABORATORY
Organic Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Semivolatiles by GC/MS	Water	Method 625	Method 8270	Method CLP OLMO1.8	Not Applicable
	Liquid	Not Applicable	Method 8270	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8270	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8270	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8270	Method CLP OLMO1.8	Not Applicable
Pesticides/ PCBs by GC	Water	Method 608	Method 8080	Method CLP OLMO1.8	Not Applicable
	Liquid	Not Applicable	Method 8080	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8080	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8080	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8080	Method CLP OLMO1.8	Not Applicable
Dioxins/ Dibenzofurans by HRGC/LRMS	Water	Method 613	Method 8280	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 8280	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8280	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8280	Not Applicable	Not Applicable

TABLE 4-7
ST. LOUIS LABORATORY
Organic Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Dioxins/ Dibenzofurans by HRGC/LRMS (continued)	Soil	Not Applicable	Method 8280	Not Applicable	Not Applicable
Nitroaromatics by GC	Water	Not Applicable	Not Applicable	Not Applicable	Quanterra St. Louis Developed Method SOP SL4094
	Liquid	Not Applicable	Not Applicable	Not Applicable	Quanterra St. Louis Developed Method SOP SL4094
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Quanterra St. Louis Developed Method SOP SL4094
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Not Applicable	Not Applicable	Quanterra St. Louis Developed Method SOP SL4094
	Soil	Not Applicable	Not Applicable	Not Applicable	Quanterra St. Louis Developed Method SOP SL4094
Total Petroleum Hydrocarbons by GC	Water	Not Applicable	Method 8015-M	Not Applicable	California LUFT
	Liquid	Not Applicable	Method 8015-M	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8015-M	Not Applicable	Not Applicable

TABLE 4-7
ST. LOUIS LABORATORY
Organic Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Total Petroleum Hydrocarbons by GC (continued)	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8015-M	Not Applicable	California LUFT
	Soil	Not Applicable	Method 8015-M	Not Applicable	California LUFT
Organophosphorus Pesticides by GC	Water	Not Applicable	Method 8140	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 8140	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8140	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8140	Not Applicable	Not Applicable
Polynuclear Aromatic Hydrocarbons (PAH) by HPLC	Water	Not Applicable	Method 8310	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 8310	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8310	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8310	Not Applicable	Not Applicable
Herbicides by GC	Water	Method 615	Method 8150	Not Applicable	Not Applicable
	Liquid	Not Applicable	Method 8150	Not Applicable	Not Applicable
	TCLP Leachate	Not Applicable	Method 8150	Not Applicable	Not Applicable

TABLE 4-7
ST. LOUIS LABORATORY
Organic Methods
(Continued)

Analytical Parameter	Matrix	Methods			
		NPDES	RCRA (SW846)	CLP	Other
Herbicides by GC (continued)	Domestic Waste, Industrial Waste, Sludge, Solids, Sediment	Not Applicable	Method 8150	Not Applicable	Not Applicable
	Soil	Not Applicable	Method 8150	Not Applicable	Not Applicable

TABLE 4-8
ST. LOUIS LABORATORY
Radiological Methods

Analytical Parameter	Matrix	Method
Gross Alpha/Beta	Water	ASTM[1] D1943-90; Standard Methods[2] 7110; EPA[3] 900.0; SW-846[4] 9310; RP710[5]
	Soil, Vegetation, Filter	SW-846 9310; Standard Methods 7110; RP710
Radium-228	Water	EPA 904.0; SW-846 9320
Tritium	Water, Filters	EPA 906.0; Standard Methods 7500-H
	Soil, Vegetation	EPA EERF[6] H-01
Total Uranium	Water	ASTM Method D5174-91 (KPA)
	Soil	ASTM Method D5174-91 (KPA)
Isotopic Uranium U-238, U-234, U-235	Water, Soil, Vegetation, Filters	NAS-NS-3050[7]
Isotopic Plutonium Pu-239/240, Pu-238	Water, Soil, Vegetation, Filters	NAS-NS-3058
Isotopic Thorium Th-228, Th-230, Th-232	Water, Soil, Vegetation, Filters	NAS-NS-3004
Technetium	Water, Soil, Vegetation, Filters	"Determination of Te^{99} by Liquid Scintillation", Goodyear Atomic Corporation[8]
Gross Alpha by Coprecipitation	Water	EPA EERF, 00-02
Americium-241	Water, Soil, Vegetation, Filters	NAS-NS-3006
Total Alpha Emitting Isoptopes of Radium	Water, Filters	EPA 903.0; SW-846 9315
Lead Pb-210	Water, Soil, Filters	EPA EERF Pb-01

TABLE 4-8
ST. LOUIS LABORATORY
Radiological Methods
(Continued)

Analytical Parameters	Matrix	Method
Polonium-210	Water	HASL-300[9], Po-02
Strontium-89,90 and Total Strontium	Water, Filters	EPA 905.0; Standard Methods 7500-Sr; HASL-300 Sr-01 & Sr-02
Radium-226/228	Soil	HASL-300, 4.5.2.3 (Gamma), EPA 901.1; ASTM D3649-85
Radium-226 Radon-222 (Emanation)	Water	EPA 903.1; ASTM D3454-86; HASL-300 Ra-03
Gamma Emitters Actinides, as applicable, Co-60, Cs-137, K-40, Mn-54, and other fission/activation products	Water, Soil, Vegetation, Filters	HASL-300, 4.5.2.3; EPA 901.1; ASTM D3649-85
Gross Gamma	Water, Soil, Vegetation, Filters	RP730

Footnotes

(1) Annual Book of American Society for Testing Materials (ASTM) Standards.

(2) Standard Methods for the Examination of Water and Waste Waters; APHA, AWWA, WEF; 18th Edition, 1992.

(3) USEPA, Prescribed Procedures for Measurement of Radioactivity in Drinking Water, No. EPA-600/4-80- 032, Cincinnati, Ohio, 1980.

(4) "Test Methods for Evaluating Solid Waste", 3rd Edition, USEPA, September 1986 and updates.

(5) U.S. Department of Energy, consolidated by Los Alamos National Laboratory, Los Alamos, New Mexico, 1993.

(6) USEPA, Eastern Environmental Radiation Facility Radiochemistry Procedures Manual, No. 520/5-84-006, 1984.

(7) National Academy of Sciences, Nuclear Science Series

(8) The Determination of Technetium-99 By Liquid Scintillation Counting, C.R. Walker, H.S. Short, H.S. Spring, Technical Division, Goodyear Atomic Corp., Piketon, Ohio.

(9) HASL, Environmental Measurements Laboratory Procedures Manual, No. HASL-300.

Facility Appendix
St. Louis Laboratory

Section St. Louis-5

MDLs and RLs

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TABLE 5-1
ST. LOUIS LABORATORY
Wet Chemistry
Method Detection Limits (MDL)
and Reporting Limits (RL)

Parameter	Method	Water MDL (mg/L)	Water RL (mg/L)	Soil MDL (mg/kg)	Soil RL (mg/kg)
Cyanide	CLP/9010/335.2	1.07	5	0.224	0.5
TOC	415.1/9060	776	1000	17.0	25
Nitrite	353.1	7.17	50	0.169	0.5
Nitrite	300.0	2.83	20	1.05	1.0
Nitrate	300.0	3.49	20	0.470	1.0
Nitrate	353.1	6.99	50	0.175	0.5
Chloride	300.0	7.99	250	4.89	3.0
Fluoride	340.2	13	100	---	---
Sulfate	300.0	38.9	1000	8.94	10.0
Fluoride	300.0	97	100	1.20	10.0
Alkalinity	310.1	306	5000	14.5	50
TOX	450.1/9020	1.49	5.0	13.9	50
Silica	370.1	300	2000	---	---
Phenols	420.2/9066	6.96	50	0.383	1.0
Total Phos.	365.1	16.3	50	4.93	10.0
Ammonia	350.1	17.5	50	0.213	0.5
TKN	351.2	83.0	100	0.463	1.0
Chlorine, Res.	330.3	31	100	---	---
Boron	212.3	43	250	---	---
Hardness	130.2	1900 ($CaC0_3$)	1000	---	---

TABLE 5-1
ST. LOUIS LABORATORY
Wet Chemistry
Method Detection Limits (MDL)
and Reporting Limits (RLs)
(Continued)

Parameter	Method	Water MDL (mg/L)	Water RL (mg/L)	Soil MDL (mg/kg)	Soil RL (mg/kg)
COD	410.4	3060	5000	---	---
TPH	418.1	213	2500	2.41	5.0
Sulfides	376.1/9030	197	1000	1.84	10.0
Acidity	305.1	5350	10000	---	---
Sulfite	377.1	800	2000	20.9	20.0
Chromium $^{+6}$	7196	---	---	0.02	4.0
Iodide	345.1	0.123	2000	---	---
Conductivity	120.1	0.66 mmhos/cm	1 mmho/cm	---	---
Turbidity	180.1	0.049 NTU	0.9NTU	---	---
BOD	405.1	---	1000	---	---
CBOD	SM5210	---	1000	---	---
Bromide	300.0	---	250	---	25.0
Oil and Grease	413.1/9070/9071	---	1000	---	0.5%
Orthophosphate	300.0	---	1000	---	10.0
TDS	160.1	---	5000	---	---
TSS	160.2	---	1000	---	---
Total Solid	160.3	---	100	---	---

TABLE 5-2
ST. LOUIS LABORATORY
ICAP Metals
Contract Required Detection Limits (CRDL)(1),
Method Detection Limits (MDL)(2),
and Reporting Limits (RLs)(3)

Element	CAS Number	Water CRDL (µg/L)	Soil CRDL(4) (mg/Kg)	Water MDL (µg/L)	Soil MDL(4) (mg/Kg)	Water RL (µg/L)	Soil RL(4) (mg/Kg)
Aluminum	7429-90-5	200	40	430	1.42	200	20
Antimony	7440-36-0	60	12	37.0	2.78	60	6
Arsenic	7440-38-2	10	2	161	12.4	500	50
Barium	7440-39-3	200	40	3.6	0.14	200	20
Beryllium	7440-41-7	5	1	1.5	0.11	5	0.5
Boron	7440-42-8	—	—	62.8	2.21	150	15
Bismuth	7440-69-9	—	—	107	4.70	100	10
Cadmium	7440-43-9	5	1	6.6	0.30	5	0.5
Calcium	7440-70-2	5000	1000	396	5.48	5000	500
Chromium	7440-47-3	10	2	8.6	0.49	20	2.0
Cobalt	7440-48-4	50	10	6.0	0.57	50	5
Copper	7440-50-8	25	5	18.8	0.63	25	2.5
Iron	7439-89-6	100	20	222	3.51	100	10
Lead	7439-92-1	3	0.6	57.3	4.27	100	10
Lithium	7439-93-2	—	—	20.7	1.38	100	10
Magnesium	7439-95-4	5000	1000	268	7.34	5000	500
Manganese	7439-96-5	15	3	4.8	0.26	15	1.5
Molybdenum	7439-98-7	—	—	9.3	0.86	200	20
Nickel	7440-02-0	40	8	7.3	1.08	40	4
Potassium	7440-09-7	5000	1000	2750	356	5000	500
Selenium	7782-49-2	5	1	76.7	3.51	250	25
Silicon	7440-21-3	—	—	534	7.81	200	20
Silver	7440-22-4	10	2	3.9	0.32	10	1

TABLE 5-2
ST. LOUIS LABORATORY
ICAP Metals
Contract Required Detection Limits (CRDL)[1],
Method Detection Limits (MDL)[2],
and Reporting Limits (RLs)[3]
(Continued)

Element	CAS Number	Water CRDL (µg/L)	Soil CRDL[4] (mg/Kg)	Water MDL (µg/L)	Soil MDL[4] (mg/Kg)	Water RL (µg/L)	Soil RL[4] (mg/Kg)
Sodium	7440-22-4	5000	1000	754	44.7	1000	100
Strontium	7440-24-6	---	---	12.5	0.10	200	20
Tellurium	13494-80-9	---	---	77.7	0.53	200	20
Thallium	7440-28-0	10	2	337	19.8	500	50
Thorium	7440-29-1	---	---	27.6	1.82	50	5
Tin	7440-31-5	---	---	79.3	3.91	200	20
Titanium	7440-32-6	---	---	3.9	2.15	200	20
Uranium	7440-62-2	---	---	90.9	9.55	500	50
Vanadium	7440-62-2	50	10	13.5	0.69	50	5
Zinc	7440-66-6	20	4	11.4	0.73	20	2
ICAP Metals, TJA61E "Supertrace"							
Arsenic	7440-38-2	10	2	1.1	---	10	1.0
Lead	7439-92-1	3	0.6	1.1	---	3	0.3
Selenium	7782-49-2	5	1	1.7	---	5	0.5
Thallium	7440-66-6	10	2	1.2	---	10	1.0

Footnotes

(1) CRDLs apply to work performed according to the USEPA Statement of Work ILM03.0 and its revisions.

(2) Method detection limits were performed according to 40 CFR Part 136 in April 1994 and September 1994 (Titanium) for waters and soils, and in June 1994 for the TJA61E (Trace) instrument.

(3) RLs were estimated from the results of water MDL determinations.

(4) Soil detection limits are based on wet weight of sample, and will be higher when converted to a dry weight basis.

TABLE 5-3
ST. LOUIS LABORATORY
AA Metals
Contract Required Detection Limits (CRDL)[1], Method Detection Limits (MDL)[2], and Reporting Limits (RLs)[3]

Element	CAS Number	Water CRDL (µg/L)	Soil CRDL[4] (mg/Kg)	Water MDL (µg/L)	Soil MDL[4] (mg/Kg)	Water RL (µg/L)	Soil RL[4] (mg/Kg)
Arsenic	7440-38-2	10	2	1.2	0.091	3	0.3
Lead	7439-92-1	3	0.6	2.4	0.098	3	0.3
Selenium	7782-49-2	5	1	0.9	0.023	3	0.3
Thallium	7440-28-0	10	2	0.6	0.204	3	0.3
Antimony	7440-36-0	60	12	8.2	0.36	6	0.6
Silver	7440-22-4	10	2	—	0.64	8	0.8
Mercury[5]	7439-97-6	0.2	0.1	0.065	0.012	0.2	0.1

Footnotes

(1) CRDLs apply to analyses performed under the Statement of Work of the USEPA Scope of Work ILM03.0 and its revisions.

(2) Method detection limits for furnace metals were determined in January 1994 (waters). Water MDLs for mercury were determined on 1/03/94 Soil MDLs for mercury were determined on 2-09-94.

(3) RLs are estimated from the method detection limit studies for water samples.

(4) Soil detection limits are based on wet weight of sample; detection limits will be higher when corrected for percent solids.

(5) Mercury is performed by cold vapor atomic absorption. The other elements are performed by graphite furnace techniques.

TABLE 5-4
ST. LOUIS LABORATORY
CLP or Hazardous Substance List for Volatile Organics with Contract Required Detection Limits (CRDL)(1), Method Detection Limits (MDL)(2) and Reporting Limits (RLs)(3)

Analyte	CAS Number	Water CRDL (μg/L)	Soil CRDL(4) (μg /Kg)	Water MDL (μg/L)	Soil MDL(4) (μg /Kg)	Water RL (μg/L)	Soil RL(4) (μg /Kg)
Chloromethane	74-87-3	10	10	2.1	1.7	10	10
Bromomethane	74-83-9	10	10	1.6	2.9	10	10
Vinyl Chloride	75-01-4	10	10	2.1	3.9	10	10
Chloroethane	75-00-3	10	10	2.1	2.8	10	10
Methylene Chloride	75-09-2	10	10	0.50	1.6	5	5
Acetone	67-64-1	10	10	2.8	5.0	100	100
Carbon Disulfide	75-15-0	10	10	1.2	2.1	5	5
1,1-Dichloroethene	75-35-4	10	10	1.0	0.92	5	5
1,1-Dichloroethane	75-34-3	10	10	0.47	0.58	5	5
1,2-Dichloroethene (total)	540-59-0	10	10	0.82	1.1	5	5
Chloroform	67-66-3	10	10	0.44	0.44	5	5
1,2-Dichloroethane	107-06-2	10	10	0.19	0.56	5	5
2-Butanone	78-93-3	10	10	3.8	8.9	100	100
1,1,1-Trichloroethane	71-55-6	10	10	0.79	0.49	5	5
Carbon Tetrachloride	56-23-5	10	10	0.85	0.52	5	5
Vinyl Acetate	108-05-4	NA	NA	0.97	6.6	50	50
Bromodichloromethane	75-27-4	10	10	0.35	0.41	5	5
1,2-Dichloropropane	78-87-5	10	10	0.35	0.97	5	5
cis-1,3-Dichloropropene	10061-01-5	10	10	0.28	0.72	5	5
2-chloroethylvinylether	110-75-8	NA	NA	1.1	2.7	10	10
Trichloroethene	79-01-6	10	10	0.53	1.2	5	5
Dibromochloromethane	124-48-1	10	10	0.22	0.22	5	5
1,1,2-Trichloroethane	79-00-5	10	10	0.44	0.80	5	5
Benzene	71-43-2	10	10	0.31	0.50	5	5

TABLE 5-4
ST. LOUIS LABORATORY
CLP or Hazardous Substance List for Volatile Organics with Contract Required Detection Limits (CRDL)(1), Method Detection Limits (MDL)(2) and Reporting Limits (RLs)(3)
(Continued)

Analyte	CAS Number	Water CRDL (μg/L)	Soil CRDL(4) (μg /Kg)	Water MDL (μg/L)	Soil MDL(4) (μg /Kg)	Water RL (μg/L)	Soil RL(4) (μg /Kg)
trans-1,3-Dichloropropene	10061-02-6	10	10	0.44	0.68	5	5
Bromoform	75-25-2	10	10	0.31	0.85	5	5
4-Methyl-2-Pentanone	108-10-1	10	10	2.0	4.2	50	50
2-Hexanone	591-78-6	10	10	1.3	6.9	50	50
Tetrachloroethene	127-18-4	10	10	0.66	3.9	5	5
Toluene	108-88-3	10	10	0.50	0.66	5	5
1,1,2,2-Tetrachloroethane	79-34-5	10	10	0.53	2.3	5	5
Chlorobenzene	108-90-7	10	10	0.38	0.57	5	5
Ethylbenzene	100-41-4	10	10	0.47	0.78	5	5
Styrene	100-42-5	10	10	0.44	0.59	5	5
Xylene (total)	1330-20-7	10	10	0.72	0.68	5	5
APPENDIX IX ADDITIONAL COMPOUNDS							
Acrolein	107-02-8	---	---	16	17	100	100
Acetonitrile	75-05-8	---	---	14	15	100	100
Iodomethane	74-88-4	---	---	0.52	0.79	5	5
Allyl Chloride	107-05-1	---	---	1.6	1.2	5	5
Acrylonitrile	107-13-1	---	---	27	31	100	100
2-Chloro-1,3-butadiene	126-99-8	---	---	2.4	0.85	5	5
Propionitrile	107-12-0	---	---	4.9	4.8	100	100
Methacrylonitrile	126-98-7	---	---	3.9	2.2	100	100
Isobutyl Alcohol	78-83-1	---	---	180	380	500	500
1,4-Dioxane	123-91-1	---	---	140	460	500	500
Methyl Methacrylate	80-62-6	---	---	1.6	0.92	5	5

TABLE 5-4
ST. LOUIS LABORATORY
CLP or Hazardous Substance List for Volatile Organics with Contract Required Detection Limits (CRDL)(1), Method Detection Limits (MDL)(2) and Reporting Limits (RLs)(3)
(Continued)

Analyte	CAS Number	Water CRDL (µg/L)	Soil CRDL(4) (µg /Kg)	Water MDL (µg/L)	Soil MDL(4) (µg /Kg)	Water RL (µg/L)	Soil RL(4) (µg /Kg)
Dibromomethane	74-95-3	---	---	0.92	0.66	5	5
Ethyl Methacrylate	97-63-2	---	---	1.0	0.55	5	5
1,2-Dibromoethane	106-93-4	---	---	0.45	0.61	5	5
1,1,1,2-Tetrachloroethane	630-20-6	---	---	0.51	0.53	5	5
trans-1,4-Dichloro-2-butene	764-41-0	---	---	11	3.1	100	100
1,2,3-Trichloropropane	96-18-4	---	---	0.67	0.82	5	5
Pentachloroethane	76-01-7	---	---	TBD	TBD	10	10
1,2-Dibromo-3-chloropropane	96-12-8	---	---	1.3	1.3	100	100

Footnotes

(1) CRDLs apply to analyses performed under the USEPA CLP Statement of Work OLMO1.0 and its revisions only.

(2) The Method Detection Limit study for water was performed on 6-10-93 and 6-11-93. The MDL study for soil was performed on 5-26-94. Both studies were run by SW-846 Method 8240. The MDLs for additional Appendix IX compounds were determined by Method 8240 on 1/15/94 for water and 2/1/94 for soil.

(3) Reporting Limits are taken from SW-846 Method 8240 unless MDL studies indicate that these are too low.

(4) Quantitation limits listed for soil are based on wet weight. The quantitation limits based on dry weight as required, will be higher.

TABLE 5-5
ST. LOUIS LABORATORY
CLP or Hazardous Substance List for Semivolatile Organics with Contract Required Detection Limits (CRDL)[1], Method Detection Limits (MDL)[2] and Reporting Limits (RLs)[3]

Analyte	CAS Number	Water CRDL (µg/L)	Soil CRDL[4] (µg /Kg)	Water MDL (µg/L)	Soil MDL[4] (µg /Kg)	Water RL (µg/L)	Soil RL[4] (µg /Kg)
Phenol	108-95-2	10	330	1.1	50.2	10	330
bis(2-Chloroethyl)ether	111-44-4	10	330	4.5	89.5	10	330
2-Chlorophenol	95-57-8	10	330	3.9	66.7	10	330
1.3-Dichlorobenzene	541-73-1	10	330	5.8	83.6	10	330
1,4-Dichlorobenzene	106-46-7	10	330	6.2	78.5	10	330
Benzyl Alcohol	100-51-6	NA	NA	1.4	65.3	20	670
1,2-Dichlorobenzene	95-50-1	10	330	6.0	86.2	10	330
2-Methylphenol	95-48-7	10	330	3.0	54.9	10	330
bis(2-chloroisopropyl)ether	108-60-1	10	330	5.6	96.3	10	330
4-Methylphenol	106-44-5	10	330	2.5	48.8	10	330
n-Nitroso-di-n-Propylamine	621-64-7	10	330	4.6	58.5	10	330
Hexachloroethane	67-72-1	10	330	5.2	90.2	10	330
Nitrobenzene	98-95-1	10	330	4.8	81.0	10	330
Isophorone	78-59-1	10	330	4.0	53.8	10	330
2-Nitrophenol	88-75-5	10	330	4.8	75.3	10	330
2,4-Dimethylphenol	105-67-9	10	330	3.7	82.5	10	330
Benzoic Acid	65-85-0	NA	NA	TBD	TBD	50	1600
bis(2-Chloroethoxy) Methane	111-91-1	10	330	4.2	63.2	10	330
2,4-Dichlorophenol	120-83-2	10	330	4.0	33.5	10	330
1,2,4-Trichlorobenzene	120-82-1	10	330	5.6	86.4	10	330
Naphthalene	91-20-3	10	330	5.7	80.9	10	330
4-Chloroaniline	106-47-8	10	330	3.3	51.5	20	670
Hexachlorobutadiene	87-68-3	10	330	5.4	86.3	10	330

TABLE 5-5
ST. LOUIS LABORATORY
CLP or Hazardous Substance List for Semivolatile Organics
with Contract Required Detection Limits (CRDL)[1], Method Detection Limits (MDL)[2] and Reporting Limits (RLs)[3]
(Continued)

Analyte	CAS Number	Water CRDL (µg/L)	Soil CRDL[4] (µg /Kg)	Water MDL (µg/L)	Soil MDL[4] (µg /Kg)	Water RL (µg/L)	Soil RL[4] (µg /Kg)
4-Chloro-3-Methylphenol	59-50-7	10	330	4.1	30.2	20	670
2-Methylnaphthalene	91-57-6	10	330	5.1	62.6	10	330
Hexachlorocyclopentadiene	77-47-4	10	330	1.2	TBD	10	330
2,4,6-Trichlorophenol	88-06-2	10	330	4.8	35.6	10	330
2,4,5-Trichlorophenol	95-95-4	25	800	4.8	32.5	10	330
2-Chloronaphthalene	91-58-7	10	330	4.4	40.7	10	330
2-Nitroaniline	88-74-4	25	800	3.7	45.6	50	1600
Dimethyl Phthalate	131-11-3	10	330	5.1	43.5	10	330
Acenaphthylene	208-96-8	10	330	3.9	44.6	10	330
2,6-Dinitrotoluene	606-20-2	10	330	3.6	40.4	10	330
3-Nitroaniline	99-09-2	25	800	3.0	36.1	50	1600
Acenaphthene	83-32-9	10	330	3.8	40.3	10	330
2,4-Dinitrophenol	51-28-5	25	800	4.8	67.3	50	1600
4-Nitrophenol	100-02-7	25	800	TBD	TBD	50	1600
Dibenzofuran	132-64-9	10	330	3.6	33.2	10	330
2,4-Dinitrotoluene	121-14-2	10	330	3.82	48.2	10	330
Diethylphthalate	84-66-2	10	330	4.7	33.4	10	330
4-Chlorophenyl-phenylether	7005-72-36	10	330	3.6	33.9	10	330
Fluorene	86-73-7	10	330	3.5	38.8	10	330
4-Nitroaniline	100-01-6	25	800	3.2	52.2	20	670
4,6-Dinitro-2-Methylphenol	534-52-1	25	800	4.5	38.4	50	1600
n-Nitrosodiphenylamine	86-30-6	10	330	3.4	39.6	10	330
4-Bromophenyl-phenylether	101-55-3	10	330	3.5	33.0	10	330

TABLE 5-5
ST. LOUIS LABORATORY
CLP or Hazardous Substance List for Semivolatile Organics with Contract Required Detection Limits (CRDL)(1), Method Detection Limits (MDL)(2) and Reporting Limits (RLs)(3)
(Continued)

Analyte	CAS Number	Water CRDL (μg/L)	Soil CRDL(4) (μg /Kg)	Water MDL (μg/L)	Soil MDL(4) (μg /Kg)	Water RL (μg/L)	Soil RL(4) (μg /Kg)
Hexachlorobenzene	118-74-1	10	330	3.3	47.1	10	330
Pentachlorophenol	87-86-5	25	800	4.4	44.2	50	1600
Phenanthrene	85-01-8	10	330	3.4	40.6	10	330
Anthracene	120-12-7	10	330	3.1	37.0	10	330
Carbazole	86-74-8	10	330	NA	NA	10	330
Di-n-Butylphthalate	84-74-2	10	330	3.5	35.6	10	330
Fluoranthene	206-44-0	10	330	3.0	38.3	10	330
Pyrene	129-00-0	10	330	3.2	32.9	10	330
Butylbenzylphthalate	85-68-7	10	330	3.9	41.5	10	330
3,3'-Dichlorobenzidine	91-94-1	10	330	3.4	56.4	20	670
Benzo(a)anthracene	56-55-3	10	330	3.2	32.1	10	330
Chrysene	218-01-9	10	330	2.9	34.7	10	330
bis(2-Ethylhexyl)phthalate	117-81-7	10	330	9.4	57.2	10	330
Di-n-Octylphthalate	117-84-0	10	330	8.5	51.7	10	330
Benzo(b)fluoranthene	205-99-2	10	330	3.1	43.3	10	330
Benzo(k)fluoranthene	207-08-9	10	330	3.8	50.4	10	330
Benzo(a)pyrene	50-32-8	10	330	3.0	43.5	10	330
Indeno(1,2,3-cd)pyrene	193-39-5	10	330	8.8	43.3	10	330
Dibenzo(a,h)anthracene	53-70-3	10	330	3.6	40.6	10	330
Benzo(g,h,i)perylene	191-24-2	10	330	3.3	48.7	10	330
Additional Appendix IX Compounds							
N-nitrosodimethylamine	62-75-9	---	---	1.3	89.1	10	330
Pyridine	110-86-1	---	---	2.8	146	10	330

TABLE 5-5
ST. LOUIS LABORATORY
CLP or Hazardous Substance List for Semivolatile Organics with Contract Required Detection Limits (CRDL)(1), Method Detection Limits (MDL)(2) and Reporting Limits (RLs)(3)
(Continued)

Analyte	CAS Number	Water CRDL (µg/L)	Soil CRDL(4) (µg /Kg)	Water MDL (µg/L)	Soil MDL(4) (µg /Kg)	Water RL (µg/L)	Soil RL(4) (µg /Kg)
Additional Appendix IX Compounds							
2-Picoline	109-06-8	---	---	1.4	64.9	10	330
N-Nitrosomethylethylamine	10595-95-6	---	---	1.5	TBD	10	330
Methyl Methanesulfonate	66-27-3	---	---	1.6	TBD	10	330
N-Nitrosodiethylamine	55-18-5	---	---	2.5	58.4	20	670
Ethyl Methanesulfonate	62-50-0	---	---	1.8	72.8	20	670
Aniline	62-53-3	---	---	2.5	63.4	10	330
N-Nitrosopyrrolidine	930-55-2	---	---	1.4	51.9	40	1300
Acetophenone	98-86-2	---	---	4.5	70.8	10	330
o-Toluidine	95-53-4	---	---	2.8	59.3	10	330
N-Nitrosomorpholine	59-89-2	---	---	1.6	59.2	10	330
N-Nitrosopiperidine	100-75-4	---	---	2.7	67.1	20	670
o,o,o-Triethylphosphor-thioate	126-68-1	---	---	5.5	TBD	20	670
a,a-Dimethylphenethylamine	122-09-8	---	---	TBD	TBD	10	330
2,6-Dichlorophenol	87-65-0	---	---	4.0	50.5	10	330
Hexachloropropene	1888-71-7	---	---	5.2	92.2	10	330
p-Phenylenediamine	106-50-3	---	---	TBD	TBD	100	3300
N-Nitrosodi-n-butylamine	924-16-3	---	---	4.4	45.8	10	330
Safrole	94-59-7	---	---	4.7	58.9	10	330
1,2,4,5-Tetrachlorobenzene	95-94-3	---	---	4.6	51.0	10	330
Isosafrole	120-58-1	---	---	4.8	55.2	10	330
1,4-Naphthoquinone	130-15-4	---	---	TBD	54.1	10	330

TABLE 5-5
ST. LOUIS LABORATORY
CLP or Hazardous Substance List for Semivolatile Organics with Contract Required Detection Limits (CRDL)[1], Method Detection Limits (MDL)[2] and Reporting Limits (RLs)[3]
(Continued)

Analyte	CAS Number	Water CRDL (µg/L)	Soil CRDL[4] (µg /Kg)	Water MDL (µg/L)	Soil MDL[4] (µg /Kg)	Water RL (µg/L)	Soil RL[4] (µg /Kg)
1,3-Dinitrobenzene	99-65-0	---	---	4.0	51.6	20	670
Pentachlorobenzene	608-93-5	---	---	3.5	36.9	10	330
1-Naphthylamine	134-32-7	---	---	1.7	29.9	10	330
2,3,4,6-Tetrachlorophenol	58-90-2	---	---	4.9	24.3	10	330
2-Naphthylamine	91-59-8	---	---	2.1	51.7	10	330
Thionazin	297-97-2	---	---	4.0	40.2	20	670
5-Nitro-o-toluidine	99-55-8	---	---	2.8	26.8	10	330
Sulfotepp	3689-24-5	---	---	3.6	36.2	40	1300
1,3,5-Trinitrobenzene	99-35-4	---	---	TBD	TBD	50	1600
Diallate (peak 1)	2303-16-4	---	---	3.2	39.7	20	670
Phorate	2310-17-0	---	---	3.4	35.3	10	330
Phenacetin	62-44-2	---	---	2.6	36.8	20	660
Diallate (peak 2)	2303-16-4	---	---	3.4	37.2	20	670
Dimethoate	60-51-5	---	---	3.5	56.1	20	670
Pentachloronitrobenzene	82-68-8	---	---	3.3	41.7	20	670
4-Aminobiphenyl	92-67-1	---	---	1.9	TBD	20	670
Pronamide	23950-58-5	---	---	3.8	45.3	20	670
Dinoseb	88-85-7	---	---	4.8	45.4	20	670
Disulfoton	298-04-4	---	---	3.4	43.1	10	330
Methyl Parathion	298-00-0	---	---	3.4	61.1	10	330
4-Nitroquinoline 1-oxide	56-57-5	---	---	3.7	99.7	40	1300

TABLE 5-5
ST. LOUIS LABORATORY
CLP or Hazardous Substance List for Semivolatile Organics
with Contract Required Detection Limits (CRDL)(1), Method Detection Limits (MDL)(2) and Reporting Limits (RLs)(3)
(Continued)

Analyte	CAS Number	Water CRDL (µg/L)	Soil CRDL(4) (µg /Kg)	Water MDL (µg/L)	Soil MDL(4) (µg /Kg)	Water RL (µg/L)	Soil RL(4) (µg /Kg)
Dinoseb	88-85-7	---	---	4.8	45.4	20	670
Disulfoton	298-04-4	---	---	3.4	43.1	10	330
Methyl Parathion	298-00-0	---	---	3.4	61.1	10	330
4-Nitroquinoline 1-oxide	56-57-5	---	---	3.7	99.7	40	1300
Parathion	56-38-2	---	---	3.4	45.8	10	330
Methapyrilene	91-80-5	---	---	1.9	219	100	3300
Isodrin	465-73-6	---	---	3.1	48.5	20	670
Aramite (peak 1)	140-57-8	---	---	TBD	TBD	20	670
Aramite (peak 2)	140-57-8	---	---	TBD	TBD	20	670
p-(Dimethylamino)azobenzene	60-11-7	---	---	3.0	50.6	10	330
Chlorobenzilate	510-15-6	---	---	3.4	39.2	10	330
Famphur	52-85-7	---	---	6.4	416	50	1600
Kepone	143-50-0	---	---	TBD	TBD	50	1600
3,3'-Dimethylbenzidine	119-90-4	---	---	3.4	56.4	10	330
2-Acetylaminofluorene	53-96-3	---	---	3.4	49.7	20	670
7,12-Dimethylbenz(a)-anthracene	57-97-6	---	---	2.8	87.2	10	330
3-Methylcholanthrene	56-49-5	---	---	4.5	56.6	10	330
Tributyl phosphate	126-73-8	---	---	21	305	100	3300

TABLE 5-5
ST. LOUIS LABORATORY
CLP or Hazardous Substance List for Semivolatile Organics with Contract Required Detection Limits (CRDL)[1], Method Detection Limits (MDL)[2] and Reporting Limits (RLs)[3]
(Continued)

Footnotes

(1) CRDLs apply to analyses performed under the USEPA CLP Statement of Work OLM01.0 and its revisions only.

(2) The Method Detection Limit for water was performed by SW-846 Method 8270A on 1-28 and 1/29/94. The MDL study for soil was performed by SW-846 Method 8270A on 1-29-94 for all compounds.

(3) Reporting Limits are taken from SW-846 Method 82700 unless MDL studies indicate that a higher RL is needed. The quantitation limits for soil are based on wet weight, and are the same with and without GPC cleanup.

(4) Quantitation limits listed are for low soil procedure, and are based on wet weight. The quantitation limits based on dry weight as required, will be higher. The quantitation limits for medium level soil procedures will be higher by a factor of 30 than the low soil limits.

TBD = To be determined

TABLE 5-6
ST. LOUIS LABORATORY
Pesticides and PCBs
Contract Required Detection Limits (CRDL)[1],
Method Detection Limits (MDL)[2], and
Reporting Limits (RLs)[3]

Analyte	CAS Number	Water CRDL (µg/L)	Soil CRDL[4] (µg /Kg)	Water MDL (µg/L)	Soil MDL[4] (µg /Kg)	Water RL (µg/L)	Soil RL[4] (µg /Kg)
a-BHC	319-84-6	0.05	1.7	0.011	1.36	0.03	0.99
b-BHC	319-85-7	0.05	1.7	0.013	0.32	0.06	2.0
d-BHC	319-86-8	0.05	1.7	0.013	0.37	0.09	3.0
g-BHC (Lindane)	58-89-9	0.05	1.7	0.0083	1.5	0.04	1.3
Heptachlor	76-44-8	0.05	1.7	0.013	1.4	0.03	0.99
Aldrin	309-00-2	0.05	1.7	0.0098	0.33	0.04	1.3
Heptachlor Epoxide	1024-57-3	0.05	1.7	0.0094	0.36	0.83	27
Endosulfan I	959-98-8	0.05	1.7	0.0087	1.5	0.14	4.6
Dieldrin	60-57-1	0.10	3.3	0.016	2.8	0.02	0.66
4,4'-DDE	72-55-9	0.10	3.3	0.014	0.67	0.04	1.3
Endrin	72-20-8	0.10	3.3	0.019	2.8	0.06	2.0
Endosulfan II	33213-65-9	0.10	3.3	0.022	2.1	0.04	1.3
4,4'-DDD	72-54-8	0.10	3.3	0.021	3.3	0.11	3.6
Endosulfan sulfate	1031-07-8	0.10	3.3	0.044	3.2	0.66	22
4,4'-DDT	50-29-3	0.10	3.3	0.033	3.0	0.12	4.0
Methoxychlor	72-43-5	0.50	17.0	0.14	15	1.8	59
Endrin Aldehyde	7421-93-4	0.10	3.3	0.037	0.66	0.23	7.6
Endrin Ketone	53494-70-5	0.10	3.3	0.029	0.72	NA	NA
a-Chlordane	5103-71-9	0.05	1.7	0.0091	0.33	NA	NA
g-Chlordane	5103-74-2	0.05	1.7	0.0075	0.34	NA	NA
Chlordane (Tech)	57-74-9	NA	NA	0.13	2.6	0.14	4.6
Toxaphene	8001-35-2	5.0	170.0	0.19	ND	2.4	79

TABLE 5-6
ST. LOUIS LABORATORY
Pesticides and PCBs
Contract Required Detection Limits (CRDL)[1],
Method Detection Limits (MDL)[2], and
Reporting Limits (RLs)[3]
(Continued)

Analyte	CAS Number	Water CRDL (µg/L)	Soil CRDL[4] (µg /Kg)	Water MDL (µg/L)	Soil MDL[4] (µg /Kg)	Water RL (µg/L)	Soil RL[4] (µg /Kg)
Aroclor 1016	12674-11-2	1.0	33.0	0.18	16.7	1.0	33
Aroclor 1221	11104-28-2	2.0	67.0	0.13	37.2	1.0	33
Aroclor 1232	11141-16-5	1.0	33.0	0.14	15.6	1.0	33
Aroclor 1242	53469-21-9	1.0	33.0	0.18	10.2	1.0	33
Aroclor 1248	12672-29-6	1.0	33.0	0.21	7.4	1.0	33
Aroclor 1254	11097-69-1	1.0	33.0	0.10	3.7	1.0	33
Aroclor 1260	11096-82-5	1.0	33.0	0.27	18	1.0	33

Footnotes

(1) CRDLs apply to analyses performed under the USEPA Scope of Work OLM01.0 and its revisions.

(2) The Method Detection Limit studies for pesticides/PCBs were performed on 1/14-1/22/94 (water) and on 2/4/93 (soil) using Method 8080.

(3) Reporting Limits are taken from SW-846 Method 8080.

(4) Quantitation limits listed for soil are based on wet weight. The quantitation limits based on dry weight as required, will be higher.

NA = Not Applicable
ND = Not Determined

TABLE 5-7
ST. LOUIS LABORATORY
Chlorinated Herbicides
Method Detection Limits (MDL)[1], and
Reporting Limits (RLs)[2]

Analyte	CAS Number	Water MDL (µg/L)	Soil MDL[3] (µg /Kg)	Water RL (µg/L)	Soil RL[3] (µg /Kg)
Dalapon	75-99-0	9.48	320	58	1160
Dicamba	1918-00-9	0.28	31.3	2.7	54
MCPA	94-74-6	97.2	8120	2490	49800
MCPP	93-65-2	122	5960	1920	38400
Dichlorprop	120-36-5	1.05	87.0	6.5	130
2,4-D	94-75-7	2.15	158	12	240
2,4,5-TP (Silvex)	93-72-1	0.19	14.9	1.7	35
2,4,5-T	93-76-5	0.21	15.1	2.0	40
Dinoseb	88-85-7	0.14	1.98	0.7	14
2,4-DB	94-82-6	1.20	84.2	9.1	182

Footnotes

(1) MDLs were determined on 1/14/93, using SW-846 Method 8150.

(2) RLs are taken from SW-846 Method 8150. The soil detection limits reflect the dilution factor obtained from a 50 gram sample taken to a volume of 10 mls.

(3) Soil detection limits are based on 50 g. wet weight. Detection limits corrected for percent solids will be higher.

TABLE 5-8
ST. LOUIS LABORATORY
Organophosphorous Pesticides
Method Detection Limits (MDL)[1], and Reporting Limits (RLs)[2]

Analyte	CAS Number	Water MDL (µg/L)	Soil MDL[3] (µg /Kg)	Water RL (µg/L)	Soil RL[3] (µg /Kg)
Demeton #1	8065-48-3	0.55	11.65	2.0	67
Diazinon	333-41-5	0.13	9.43	1.0	33
Disulfoton	298-04-4	0.12	8.23	1.0	33
Methyl Parathion	298-00-0	0.11	8.24	1.0	33
Malathion	121-75-5	0.12	7.91	1.0	33
Ethyl Parathion	56-38-2	0.10	9.20	1.0	33
Ethion	563-12-2	0.09	8.70	1.0	33
Azinphos Methyl	86-50-0	0.43	17.29	2.5	83
Demeton #2	8065-48-3	0.56	9.69	2.0	67

Footnotes

(1) MDLs for water analyses were determined on 2/3/93, and for soils on 7/27/94, both using SW-846 Method 8140.

(2) RLs are determined from the low standard run for Method 8140.

(3) Soil detection limits are based on 30 g. wet weight. Detection limits corrected for percent solids will be higher.

TABLE 5-9
ST. LOUIS LABORATORY
Aromatic Volatiles by GC
Method Detection Limits (MDL)[1], and
Reporting Limits (RLs)[2]

Analyte	CAS Number	Water MDL (µg/L)	Soil MDL[3] (µg /Kg)	Water RL (µg/L)	Soil RL[3] (µg /Kg)
Benzene	71-43-2	0.09	0.06	2.0	2.0
Chlorobenzene	108-90-7	0.16	0.22	2.0	2.0
1,4-Dichlorobenzene	106-46-7	0.38	0.75	3.0	3.0
1,3-Dichlorobenzene	541-73-1	0.25	0.38	4.0	4.0
1,2-Dichlorobenzene	95-50-1	0.35	0.69	4.0	4.0
Ethylbenzene	100-41-4	0.16	0.19	2.0	2.0
Toluene	108-88-3	0.16	0.38	2.0	2.0
m,p-Xylene	---	0.19	0.44	2.0	2.0
o-Xylene	95-47-6	0.19	0.94	2.0	2.0

Footnotes

(1) MDLs were determined on 8/27/93 for water and on 8/19/93 for soil samples using SW-846 Method 8020.

(2) RLs are taken from SW-846 Method 8020, with the exception of the RLs for xylenes, which are determined by comparison to the other RLs.

(3) Soil detection limits are based on 5 g. wet weight. Detection limits corrected for percent solids will be higher.

TABLE 5-10
ST. LOUIS LABORATORY
Polynuclear Aromatic Hydrocarbons by HPLC
Method Detection Limits (MDL)[1], and
Reporting Limits (RLs)[2]

Analyte	CAS Number	Water MDL (mg/L)	Water RL (mg/L)	Soil MDL (mg/kg)	Soil RL (mg/kg)
Naphthalene	91-20-3	1.2	18	219	590
Acenaphthylene	208-96-8	1.5	23	226	760
Acenaphthene	83-32-9	1.6	18	260	590
Fluorene	86-73-7	0.24	2.1	63	69
Phenanthrene	85-01-8	0.29	6.4	60	211
Anthracene	120-12-7	1.2	6.6	74	218
Fluoranthene	206-44-0	0.22	2.1	48	69
Pyrene	129-00-0	0.33	2.7	57	89
Benzo(a)anthracene	56-55-3	0.063	0.13	11	4.3
Chrysene	218-01-9	0.062	1.5	12	50
Benzo(b)fluoranthene	205-99-2	0.057	0.18	12	5.9
Benzo(k)fluoranthene	207-08-9	0.11	0.17	18	5.6
Benzo(a)pyrene	50-32-8	0.048	0.23	11	7.6
Dibenzo(ah)anthracene	53-70-3	0.16	0.30	25	9.9
Benzo(ghi)perylene	191-24-2	0.099	0.76	22	25
Indeno(123-cd)pyrene	193-39-5	0.10	0.43	23	14

Footnotes

(1) MDLs for water analyses were determined on 8/10/93, and for soils on 7/21/93, both using SW-846 Method 8310.

(2) RLs are taken from SW-846 Method 8310.

TABLE 5-11
ST. LOUIS LABORATORY
Polychlorinated Dioxins and Furans
Method Detection Limits (MDL)(1), and
Reporting Limits (RLs)(2)

Analyte	CAS Number	Water MDL (μg/L)	Soil MDL(3) (μg /Kg)	Water RL (μg/L)	Soil RL(3) (μg /Kg)
2,3,7,8-TCDD	1746-01-6	1.12	0.27	10	1.0
1,2,3,7,8-PeCDD	40321-76-4	1.74	0.42	25	2.5
1,2,3,4,7,8-HxCDD	39227-28-6	1.87	0.54	25	2.5
1,2,3,6,7,8-HxCDD	57653-85-7	2.42	0.64	25	2.5
1,2,3,7,8,9-HxCDD	19408-74-3	1.16	0.70	25	2.5
2,3,7,8-TCDF	51207-31-9	3.95	0.13	10	1.0
1,2,3,7,8-PeCDF	57117-41-6	4.87	0.49	25	2.5
2,3,4,7,8-PeCDF	57117-31-4	5.24	0.38	25	2.5
1,2,3,4,7,8-HxCDF	70648-26-9	12.09	0.44	25	2.5
1,2,3,6,7,8-HxCDF	57117-44-9	9.85	0.38	25	2.5
2,3,4,6,7,8-HxCDF	60851-34-5	4.91	0.38	25	2.5
1,2,3,7,8,9-HxCDF	72918-21-9	4.52	0.38	25	2.5
1,2,3,4,6,7,8-HpCDD	35822-46-9	3.32	0.19	25	2.5
OCDD	3268-87-9	17.39	0.19	50	5.0
1,2,3,4,6,7,8-HpCDF	67562-39-4	13.50	0.42	25	2.5
OCDF	55673-89-7	5.19	0.14	25	2.5
	39001-02-0	20.33	0.84	50	5.0
2,3,7,8-TCDD **(Method 613)**	1746-01-6	0.18	----	2.0	---

Footnotes

(1) MDLs for water analyses were determined on 9/07/93, and for soils on 3/22/93, both using SW-846 Method 8280. The MDL for method 613 was determined in April, 1994.

(2) RLs are taken from the USEPA CLP Statement of Work for Analysis of Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans, Document Number DFLM01.1, and from 40CFR Part 136, Method 613.

(3) Soil detection limits are based on 10 g. wet weight. Detection limits corrected for percent solids will be higher.

TABLE 5-12
ST. LOUIS LABORATORY
Radiochemical Target Detection Limits

Analytical Parameter	Matrix	Detection Limit[1]
Total Uranium	Water*	1 mg/L (KPA)
	Soil	0.5 mg/g (KPA)
Radium-228	Water	3 pCi/L
Tritium	Water	500 pCi/L
	Soil	500 pCi/L or 1 pCi/g
Gross Alpha	Water	5 pCi/L[2]
	Soil, Vegetation	10 pCi/g
	Filter	1 pCi/filter
Gross Beta	Water	3 pCi/L
	Soil, Vegetation	10 pCi/g
	Filter	2 pCi/filter
Total Alpha Emitting Isotopes for Radium	Water, Vegetation	1 pCi/unit volume
Radium-226/228	Soil	1 pCi/g (Ra-226)
		3 pCi/g (Ra-228)
Isotopic Americium, Uranium, Plutonium, Thorium	Water	1 pCi/L
	Soil	1 pCi/g
	Vegetation	1 pCi/g
	Filter	1 pCi/filter
Technetium-99	Water, Filter	3 pCi/L
	Soil, Vegetation	2 pCi/g
Strontium-89/90	Water, Filter	10/5 pCi/L
	Soil, Vegetation	3/1 pCi/g
Polonium-210	Water	1 pCi/L
Lead-210	Water	5 pCi/L

TABLE 5-12
ST. LOUIS LABORATORY
Radiochemical Target Detection Limits
(Continued)

Analytical Parameter	Matrix	Detection Limit[1]
Gamma	Water, Filter	20 pCi/L (based on Cs-137)
	Soil, Vegetation	2 pCi/g (based on Cs-137)
Ra-226/Rn-222 by Emanation	Water	0.2 pCi/L

Footnotes

(1) Detection limits are based on standard volume and standard count times. Lower detection may be achievable by increasing sample volume or count durations. Analytical conditions will be adjusted as necessary to ensure client required detection limits are achieved, unless interferences, contaminants, and other matrix problems are encountered.

(2) Achievable only when dissolved solids <500 ppm.

TABLE -5-13
ST. LOUIS LABORATORY
Nonhalogenated Volatile Organics
Method Detection Limits (MDL)[1], and
Reporting Limits (RLs)[2]

Analyte	CAS Number	Water MDL (µg/L)	Water RL (µg/L)
Acrolein	107-02-8	1.88	5.0
Diethyl Ether	60-29-7	0.50	5.0
Acrylonitrile	107-13-1	2.10	7.0
2-Butanone	78-93-3	1.54	10.0
Ethanol	64-17-5	385	1
Isobutyl Alcohol	78-83-1	13	100
1,4-Dioxane	123-91-1	3	100
4-Methyl-2-pentanone	108-10-1	0.28	5.0

Footnotes

(1) MDLs were determined according to the procedure described in SW-846 Method 8015/8030 and EPA Method 603 on 1-29-94 and 1-31-94.

(2) RLs are taken from SW-846 Methods 8015A and 8030A where available, otherwise estimated from MDL and sensitivity data.

TABLE 5-14
ST. LOUIS LABORATORY
Petroleum Hydrocarbons by Method 8015-modified and California LUFT
Method Detection Limits (MDL)[1] and
Reporting Limits (RLs)[2]

Analyte	Water MDL (mg/L)	Soil MDL (mg/kg)	Water RL (mg/L)	Soil RL (mg/kg)
Gasoline (Low Boiling Hydrocarbons)	76.9	76.9	500	500
Extractable TPH (High Boiling Hydrocarbons)	30	3780	500	25000

Footnotes

(1) MDLs for Low Boiling Hydrocarbons were determined on 12/8/93. MDLs for Extractable TPH were determined on 10/6/93 (water) and 10/4/93 (soil).

(2) RLs are estimated from MDL and sensitivity studies. The RLs for soil are based on wet weight.

Facility Appendix
St. Louis Laboratory

Section St. Louis-6

Performance
Evaluation
Studies

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TABLE 6-1
ST. LOUIS LABORATORY
Performance Evaluation Studies

PE Sample Program Description	Analysis Performed	Frequency of Participation
USEPA Water Supply Performance Evaluation Study- Environmental Monitoring Systems Laboratory- Cincinnati	Trace Metals, Minerals, Nutrients, Demands, PCBs, Pesticides, Volatile Halocarbons, Volatile Aromatics and Miscellaneous Parameters, in Water	Bi-Annually
USEPA Water Pollution Performance Evaluation Study - Environmental Monitoring Systems Laboratory - Cincinnati	Trace Metals, Nitrate/Nitrite/Fluoride, Trihalomethanes, Volatile Organics and Miscellaneous Parameters, in Water	Bi-Annually
USEPA Inorganic Performance Evaluation Study - Environmental Monitoring Systems Laboratory - Las Vegas	Metals in Water and Soil. TAL[(1)]	Quarterly
USEPA Environmental Radioactivity Laboratory Intercomparison Studies Program - Environmental Monitoring Systems Laboratory - Las Vegas	U-Total, $^{226/228}$Ra, Gross α/ß, $^{89/90}$Sr, ^{239}Pu, and ^{3}H in Water. Gamma Emitters in Water. Blind Samples A & B in Water. Gross α/ß, ^{90}Sr, ^{137}Cs in Filters.	Monthly
Department of Energy Environmental Measurements Laboratory (DOE-EML) Office of Environmental Restoration and Waste Management, Quality Assessment Program - New York	Gamma Emitters, ^{90}Sr, $^{238/239}$Pu, ^{241}Am, $^{234/238}$U, and U-Total in Filters. Gamma Emitters, ^{90}Sr, ^{239}Pu, ^{241}Am, and $^{234/238}$U in Soil. Gamma Emitters, ^{90}Sr, $^{238/239}$Pu and ^{241}Am in Vegetation. Gamma Emitters, ^{90}Sr, $^{238/239}$Pu, ^{241}Am, $^{234/238}$U and U-Total in Water.	Bi-Annually
Department of Energy Mixed Analyte Performance Evaluation Program (MAPEP) - Idaho Operations Office	Metals, Gamma Emitters, ^{90}Sr, ^{239}Pu	Bi-Annually

Footnotes

(1) Target Analyte List USEPA CLP ILM03.0

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Facility Appendix

St. Louis Laboratory

Section St. Louis-7

Additional
Operation-Specific
Information

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TABLE 7-1
ST. LOUIS LABORATORY
Summary of Radiological Instrument Calibrations

Detector	Type	Minimum Frequency	Criteria
Gas Proportional Counter	Initial Calibration	Annually	±10% of NIST traceable standard
	Self-Absorption	Verify Annually	Alpha mass thickness < 10 mg/cm^2 Beta mass thickness < 10 mg/cm^2
	Check Source	Daily	±3 Standard Deviations from Control Chart
	Background	Daily	±3 Standard Deviations from Control Chart
Alpha Spectrometry	Initial Calibration	Annually	10,000 counts
	Pulser Check	Daily	±100 KeV of true value
	Energy Calibration Check	Weekly	Peak Resolution at FWHM (Full Width at Half Maximum Height) ≤100 KeV
	Efficiency Check	Weekly	Minimum 10,000 counts; uncertainty ≤2%
	Background	Monthly	1,000 minutes
KPA	Initial Calibration	Per Batch	5 low and 5 high standards; $r^2 \geq 0.96$; lifetime between 100-340 ms
	Calibration Check	Per Batch	1 low and 1 high; must be within 2s error
	Background	Per Batch	1 low and 1 high standard, $r^2 \geq 0.96$; lifetime between 100-340 ms
Radon Emanation Counter	Check Source	Per Batch	±3 Standard Deviations from Control Chart
	Cell Efficiency	Annually	> 1000 counts
	Background	Per Batch	≥ sample count time

TABLE 7-1
ST. LOUIS LABORATORY
Summary of Radiological Instrument Calibrations
(Continued)

Detector	Type	Minimum Frequency	Criteria
Gamma Spectrometer	Inital Calibration	Annually	± 10% of NIST source
	Check Source	Daily	±3 Standard Deviations from Control Chart
	Background Check	Daily	±3 Standard Deviations from Control Chart
	Background	Monthly	1000 minutes
Liquid Scintillation	Initial Calibration	Monthly	Per manufacturer Quench curves ≥ 100,000 counts
	Check Source	Per Batch	≥ 100,000 counts
	Background	Per Batch	±3 Standard Deviations from Control Chart
	Efficiency	Per Batch	±3 Standard Deviations from Control Chart
	Quench Curve Check	Per Batch	Per manufacturer

TABLE 7-2
ST. LOUIS LABORATORY
Minimum Radiological Quality Control Samples

Analytical Parameters	QC Sample	Quality Control
Gross Alpha/Beta	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Evaluate data; reanalyze batch or flag data for client evaluation
Radium-228	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Evaluate data; reanalyze batch of flag data for client evaluation
	Carrier	Frequency: Carrier added to each sample, blank and QC sample Criteria: Carrier recovery shall be 20-110% Corrective Action: Evaluate data; reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria.
Tritium	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Evaluate data; reanalyze batch or flag data for client evaluation

TABLE 7-2
ST. LOUIS LABORATORY
Minimum Radiological Quality Control Samples
(Continued)

Analytical Parameters	QC Sample	Quality Control
Total Uranium	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or 40% for solids unless activity is < 5% MDA Corrective Action: Evaluate data; reanalyze batch or flag data for client evaluation
Isotopic Uranium U-238, U-234, U-235	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
Isotopic Uranium U-238, U-234, U-235 (continued)	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Evaluate data; reanalyze batch or flag data for client evaluation
	Tracer	Frequency: Tracer added to each sample, blank and QC sample Criteria: Tracer recovery shall be 20-110% Corrective Action: Reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria
Isotopic Plutonium Pu-239/240, Pu-238	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Evaluate data; reanalyze batch or flag data for client evaluation

TABLE 7-2
ST. LOUIS LABORATORY
Minimum Radiological Quality Control Samples
(Continued)

Analytical Parameters	QC Sample	Quality Control
Isotopic Plutonium Pu-239/240, Pu-238 (continued)	Tracer	Frequency: Tracer added to each sample, blank and QC sample Criteria: Tracer recovery shall be 20-110% Corrective Action: Reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria
Isotopic Thorium Th-228, Th-230, Th-232	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Evaluate data; reanalyze batch or flag data for client evaluation
	Tracer	Frequency: Tracer added to each sample, blank and QC sample Criteria: Tracer recovery shall be 20-110% Corrective Action: Reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria
Technetium-99	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Evaluate data; reanalyze batch or flag data for client evaluation

TABLE 7-2
ST. LOUIS LABORATORY
Minimum Radiological Quality Control Samples
(Continued)

Analytical Parameters	QC Sample	Quality Control
Technetium-99 (continued)	Tracer	Frequency: Tracer added to each sample, blank and QC sample Criteria: Tracer recovery shall be 20-110% Corrective Action: Reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria
Gross Alpha by Coprecipitation	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Evaluate data; reanalyze sample or flag data for client evaluation
Americium-241	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Flag data for client evaluation
	Tracer	Frequency: Tracer added to each sample, blank and QC sample Criteria: Tracer recovery shall be 20-110% Corrective Action: Reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria

TABLE 7-2
ST. LOUIS LABORATORY
Minimum Radiological Quality Control Samples
(Continued)

Analytical Parameters	QC Sample	Quality Control
Total Alpha Emitting Isoptopes of Radium	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Flag data for client evaluation
	Carrier	Frequency: Carrier added to each sample, blank and QC sample Criteria: Carrier recovery shall be 20-110% Corrective Action: Reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria
Lead Pb-210	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Flag data for client evaluation
	Tracer	Frequency: Tracer added to each sample, blank and QC sample Criteria: Tracer recovery shall be 20-110% Corrective Action: Reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria
Polonium-210	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch

TABLE 7-2
ST. LOUIS LABORATORY
Minimum Radiological Quality Control Samples
(Continued)

Analytical Parameters	QC Sample	Quality Control
Polonium-210 (continued)	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Flag data for client evaluation
	Tracer	Frequency: Tracer added to each sample, blank and QC sample Criteria: Tracer recovery shall be 20-110% Corrective Action: Reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria
Strontium-89,90 and Total Strontium	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Flag data for client evaluation
	Carrier	Frequency: Carrier added to each sample, blank and QC sample Criteria: Carrier recovery shall be 20-110% Corrective Action: Reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria
Radium-226/228	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch

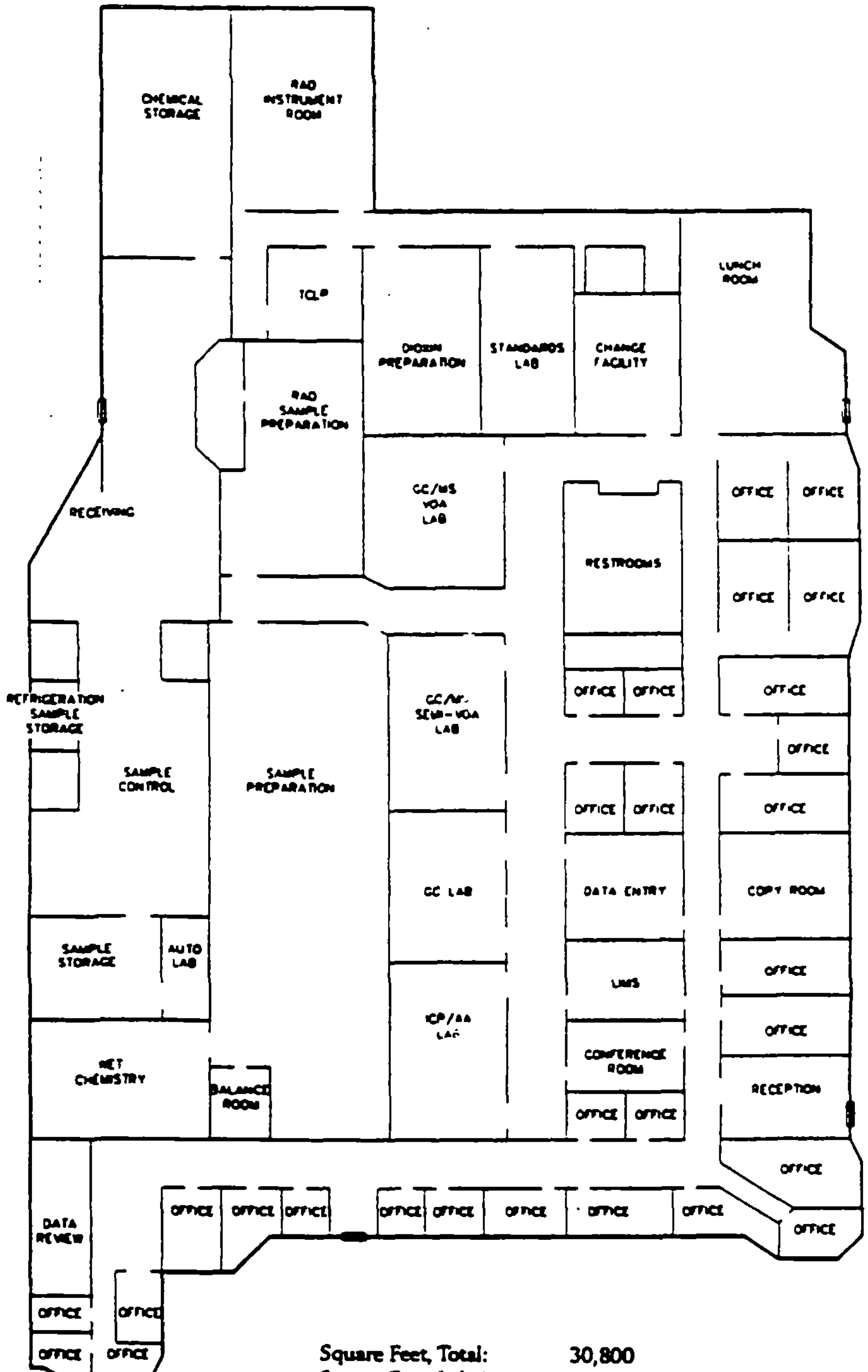
TABLE 7-2
ST. LOUIS LABORATORY
Minimum Radiological Quality Control Samples
(Continued)

Analytical Parameters	QC Sample	Quality Control
Radium-226/228 (continued)	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Flag data for client evaluation
	Carrier	Frequency: Carrier added to each sample, blank and QC sample Criteria: Carrier recovery shall be 20-110% Corrective Action: Reanalyze analytical batch if yield for blank or LCS is outside acceptance criteria. Reanalyze samples with yield outside acceptance criteria
Radium-226 Radon-222 (Emanation)	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Flag data for client evaluation
Gamma Emitters Actinides, as applicable, Co-60, Cs-137, K-40, Mn-54, and other fission/activation products	Method Blank	Frequency: 1 per analytical batch of ≤ 20 samples of the same matrix Criteria: Activity is ≤ Contract Detection Limit Corrective Action: Evaluate data; reanalyze blank and associated sample batch
	Laboratory Control Sample	Frequency: 1 per analytical batch of ≤ 20 samples of the sample matrix Criteria: ± 3s of the mean recovery as determined by control tables Corrective Action: Evaluate data; reanalyze LCS and associated sample batch
	Duplicate Sample	Frequency: 1 per batch of ≤ 20 samples of the same matrix within a 14-day period Criteria: ± 25% for water or ± 40% for solids unless activity is < 5% MDA Corrective Action: Flag data for client evaluation

Note: Samples associated with a contaminated blank do not need to be reanalyzed if the level of isotope found in the sample is either below the reporting limit or is 10 times the level in the blank.
Samples showing a low carrier or tracer recovery need to be reanalyzed only once if the reanalysis confirms a matrix effect.

St. Louis Floor Plan

(Not to Scale)



Square Feet, Total:	30,800
Square Feet, Lab Area:	18,800
Square Feet, Storage:	2,000
Linear Feet, Bench Top:	630
Linear Feet, Hoods:	110

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN
APPENDIX A-2
FINAL
QUALITY ASSURANCE PROJECT PLAN

ATTACHMENT 2

FIELD ACTIVITIES AUDIT CHECKLIST

GOLDER ASSOCIATES' INTERNAL FIELD AUDIT
GROUNDWATER SAMPLING

Date of Field Audit: ______________________

Person Conducting Audit: ______________________

Sampling Team Audited: ______________________
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____

Monitoring Well(s) Sampled: ______________________

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION
SAMPLING DOCUMENTS		
	Field Sampling Plan.	
	Health & Safety Plan.	
	Quality Assurance Project Plan.	
	Monitoring well construction diagrams.	
	Calculations of well volumes for purging.	
	Bound log book.	
SAMPLING ASSIGNMENTS		
	Sample bottle assignment.	

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION
	Equipment preparation.	
	Paperwork preparation.	
	Instrument calibration.	
	Communications	
	Vehicles	
	Site map displayed.	
	Sample collection tracking.	
	Sample log book.	
	Field manager log book.	
	Field form completion.	
	Chain of Custody - field.	
	Work zone set up.	
GROUNDWATER SAMPLING EQUIPMENT AND MATERIALS		
	PID, and calibration kit.	
	OVM and calibration kit.	
	Water level indicator.	
	Specific conductance meter.	
	Thermometer.	
	Turbidity meter.	
	pH probe.	

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION
	Bailer(s) or sampling pump(s), stainless steel or teflon tubing, connections or material.	
	In-line filtering apparatus with 0.45 micron filter.	
	Sample bottles and preservatives for TCL parameters. - as outlined in Field Sampling Plan.	
	Sample bottles and preservatives for TOC. - as outlined in Field Sampling Plan.	
	Sample bottles and preservative for TAL parameters. - as outlined in Field Sampling Plan.	
	Sample bottles and preservatives for Water Quality Parameters. - as outlined in Field Sampling Plan.	
	Field forms: - chain-of-custody/request for analysis - sample labels - shipping forms	
	Coolers and ice packs.	
	Packaging tape.	

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION
SAMPLING PROCEDURES		
	Plastic sheeting placed around well head to prevent possible contamination of sampling equipment.	
	Field equipment calibrated and calibrations documented. Calibration procedures are correct: - PID - specific conductance (SC) - turbidity - pH	
	Purging of Monitoring Well: - equipment decontaminated as per Section 10.0 of FSP. - water level measurement taken. - three well volumes removed. - temperature stabilized as per Section 3.4.3 of FSP. - pH stabilized as per Section 3.4.3 of FSP. - SC stabilized as per Section 3.4.3 of FSP. - purging method? - purge water containerized?	
	Environmental Samples: - sampling equipment decontaminated as per Section 10.0 of FSP - decontamination fluids containerized. - headspace analysis on partially filled container - pH measured - turbidity measured - temperature measured - SC measured	

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION
	Environmental Samples (continued): - both filtered and unfiltered TAL metals. - TAL metals filtered with 0.45 micron in-line filter. - VOA vials have no headspace. - method to collect samples (pump or bailer). Procedures as per Section 3.4.3 of FSP. - samples labeled appropriately. - samples placed immediately in ice filled coolers.	
	QA/QC Samples (if appropriate for the well being field audited): - field blank prepared using laboratory supplied water and same collection equipment as environmental samples, and correct labelling. - field duplicate with correct labelling. - MS/MSD with correct labelling. - samples placed immediately in ice filled coolers.	
	Sample Shipping: - trip blank shipped with VOA environmental samples. - chain-of-custody filled out and included with samples. - ice packs included in cooler. - samples packaged to minimize possibility of damage. - samples shipped the same day as collection. - samples forms specify next day delivery.	

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION
HEALTH & SAFETY		
	Health & Safety meeting	
	- Contaminants of Concern (Rates of Exposure)	
	- Action limit	
	Daily sign in/out sheet	
	Work zone entry/exit logs	
	Instrument calibration	
	Equipment storage	
	Work zone set up	
	MSDS	
	OSHA Poster	
	Personnel Paperwork	
	- 40 hour	
	- 8 hour refresher	
	- Medical monitoring	
	- Fit test records	
	Phone numbers - emergency	
	Hospital route map	
	Contaminant reduction Zone	
	- eyewash	

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION
	- 1st aid	
	- towels	
	- garbage bag	
	- decon supplies	
	- fire extinguisher	
	Personnel decon	
	Support zone - uncontaminated	
	Personal protective equipment	
	15 minute eyewash	
	Vehicles	
	Fire extinguisher	
	1st aid	
	Eye wash	
	Heat stress - cold exposure	
	Work - rest regimes	
	Accident report form	
	Health & Safety Plan sign sheet	
	Health & Safety meeting sign sheet	
	1st Aid & CPR Personnel	
	- Bee strings	
	- Frostbite	

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION
	- Heat stress	
FIELD LOG BOOK ENTRY		
	Date, start time noted	
	Temperature, weather conditions	
	Barometric pressure	
	List of field personnel on site	
	Level of protection	
	Film roll number and number of photos at each site recorded	
	List of field equipment used, with date of last calibration noted "Significant" observations	
	List of visitors, purpose	
	All field measurement made recorded	
	Description of sample collected and location	
	Time of sample collection, depth, volume collected, number of bottles filled	
	Signature of person entering in log	
	Countersignature	
SAMPLE PACKING		
	Separate QC lab samples from QA lab samples, lit on separate custody forms	

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION
	Label number matches tag number on bottle	
	Notation of preservative added on tag and label	
	Put bottles in ziplocks	
	Check custody form against cooler contents	
	Tag and label number recorded on custody form	
	Tag info matches label info matches custody form	
	Glass bottles in foam sleeves	
	Set aside custody seal numbers for sealing cooler	
	Date, sign, time on custody form, add custody seal numbers to be used on form	
	Put custody form and return address label in ziplock, tape to inside lid	
	"This end up" stickers (all four sides)	
	Arrow stickers (all four sides)	
	Fragile stickers (all four sides and top)	
	Address label (top), cover with clear tape	
	Custody seals over latches, cover with clear tape	
	Seal cooler with strapping tape, do not obliterate stickers, address or seals	
TELEPHONE CALLS		
	Calls Project Manager	

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION
	Get UPS confirmation numbers for shipment, get date, arrival time of coolers at labs	
	Call lab to obtain number of coolers, date and time of arrival	

Check If Aspect Is Correct	ASPECT	COMMENTS NONCONFORMANCE/DISPOSITION/CORRECTIVE ACTION

ADDITIONAL COMMENTS/RECOMMENDATIONS:

(65136886.wpl/srh)